TECHNOLOGY DEPT.

Gas Journal

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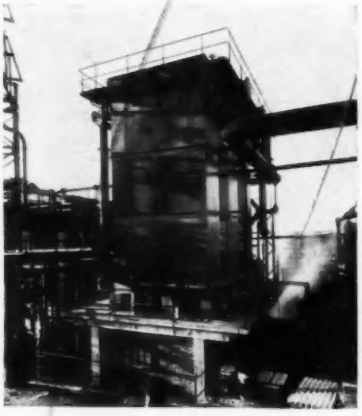

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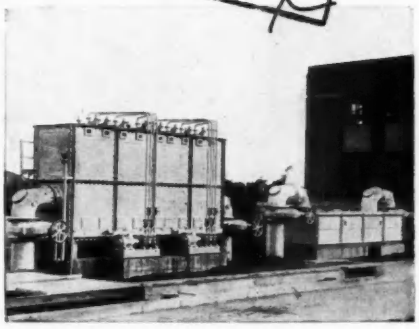

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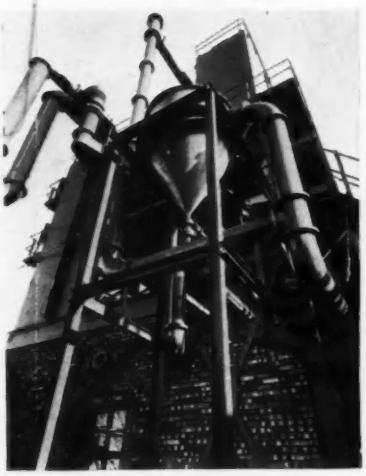

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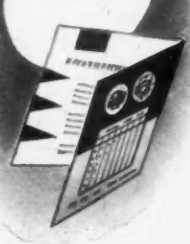

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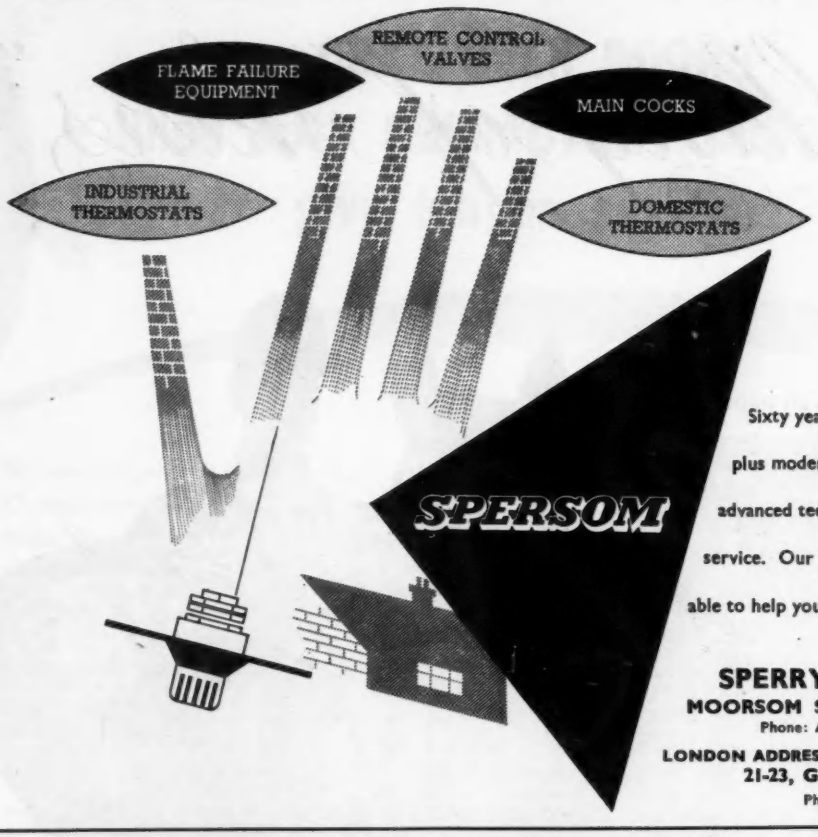

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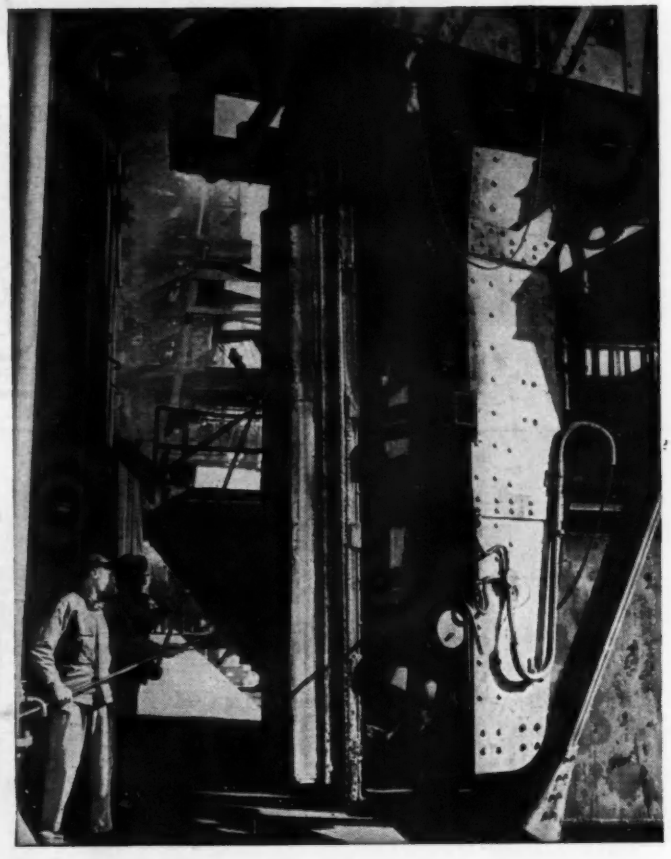

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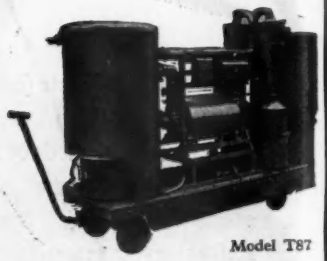

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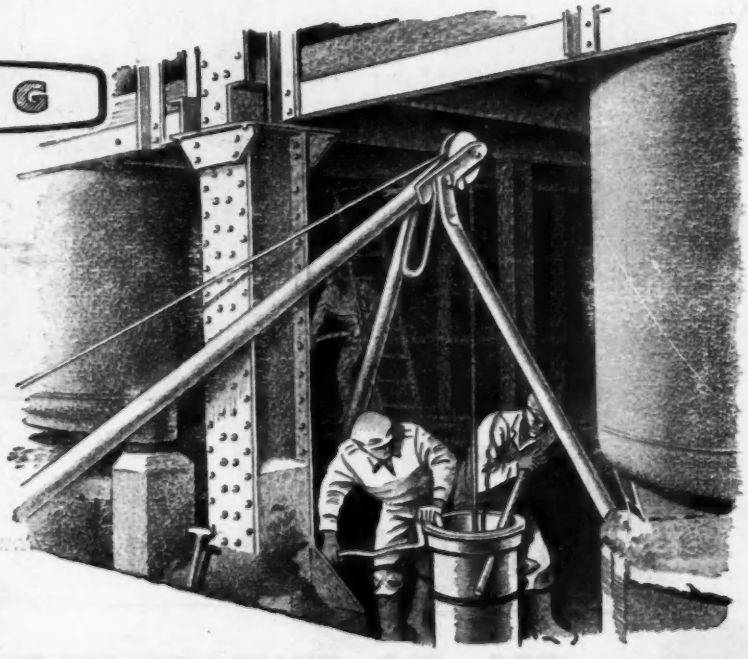

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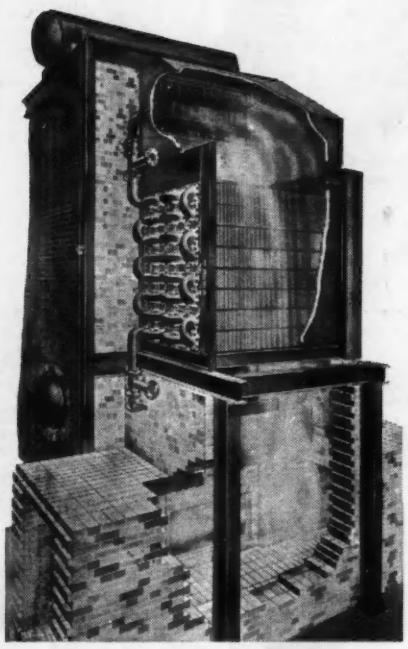
in the boiler house



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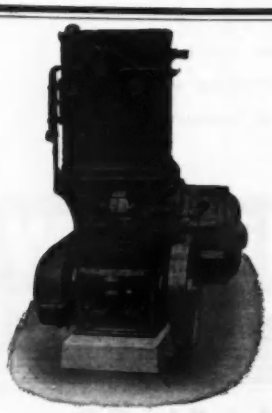

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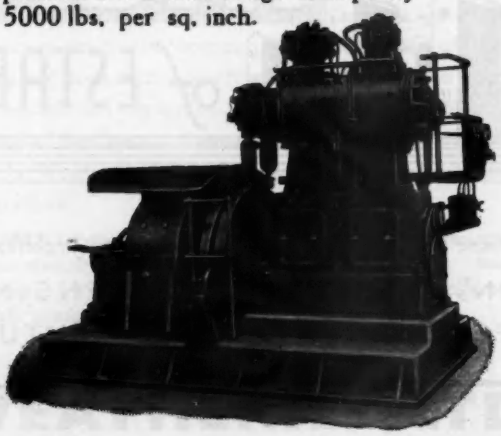

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he loads with it

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2

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3

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The C. & T. Light Mobile Stacker is available in four sizes with maximum delivery heights between 10 ft. 8 in. and 18 ft. At minimum elevation the exceptionally low overall height allows easy access to all parts for maintenance. Drive is electric, diesel or petrol.

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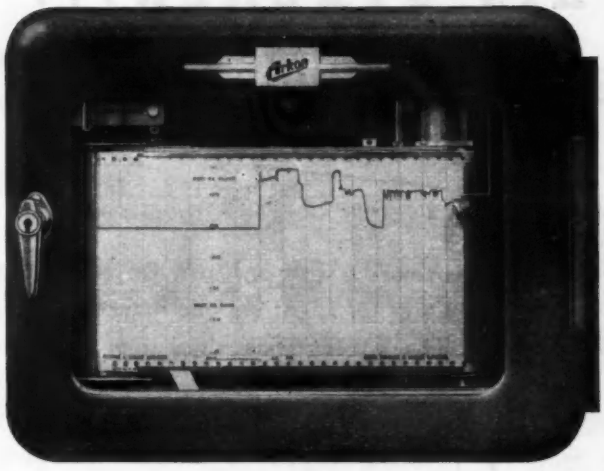

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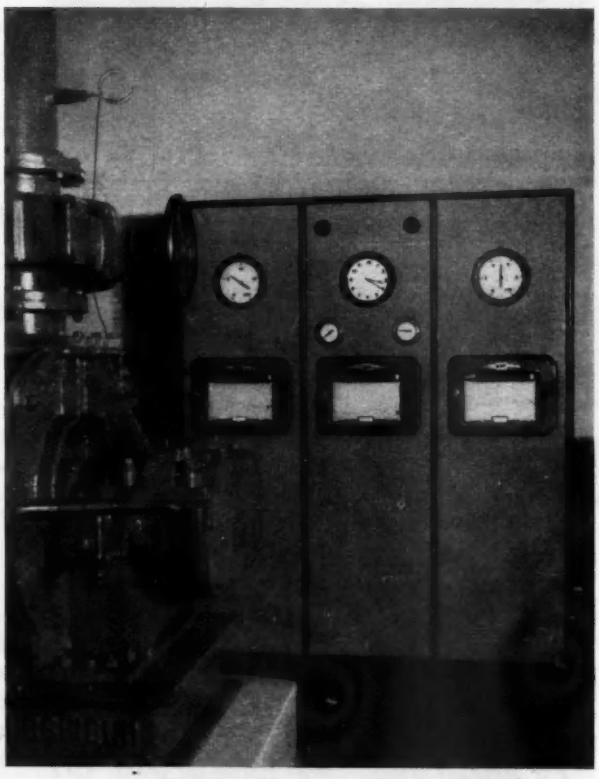

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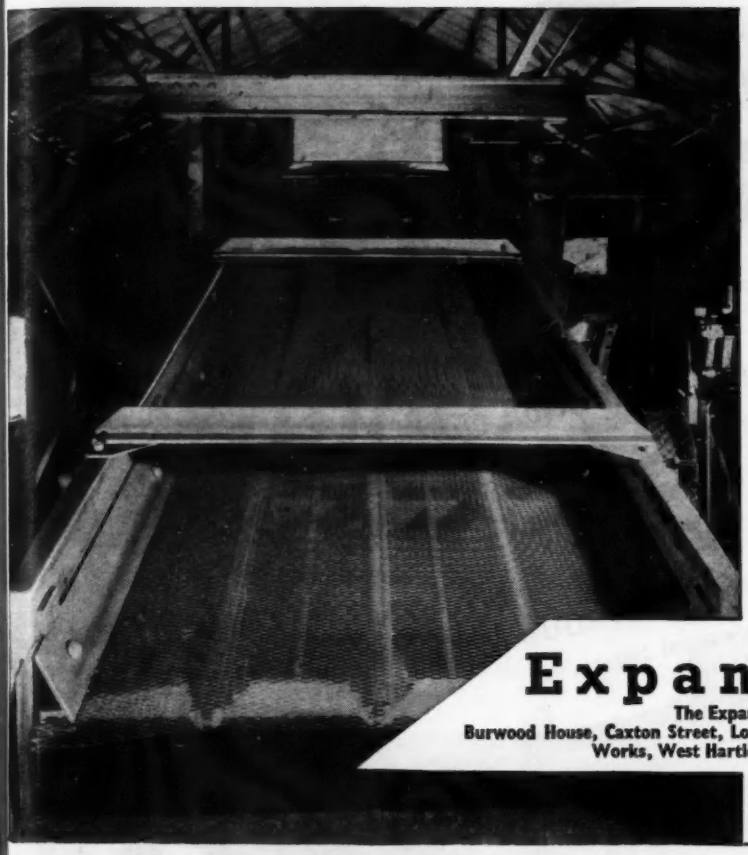

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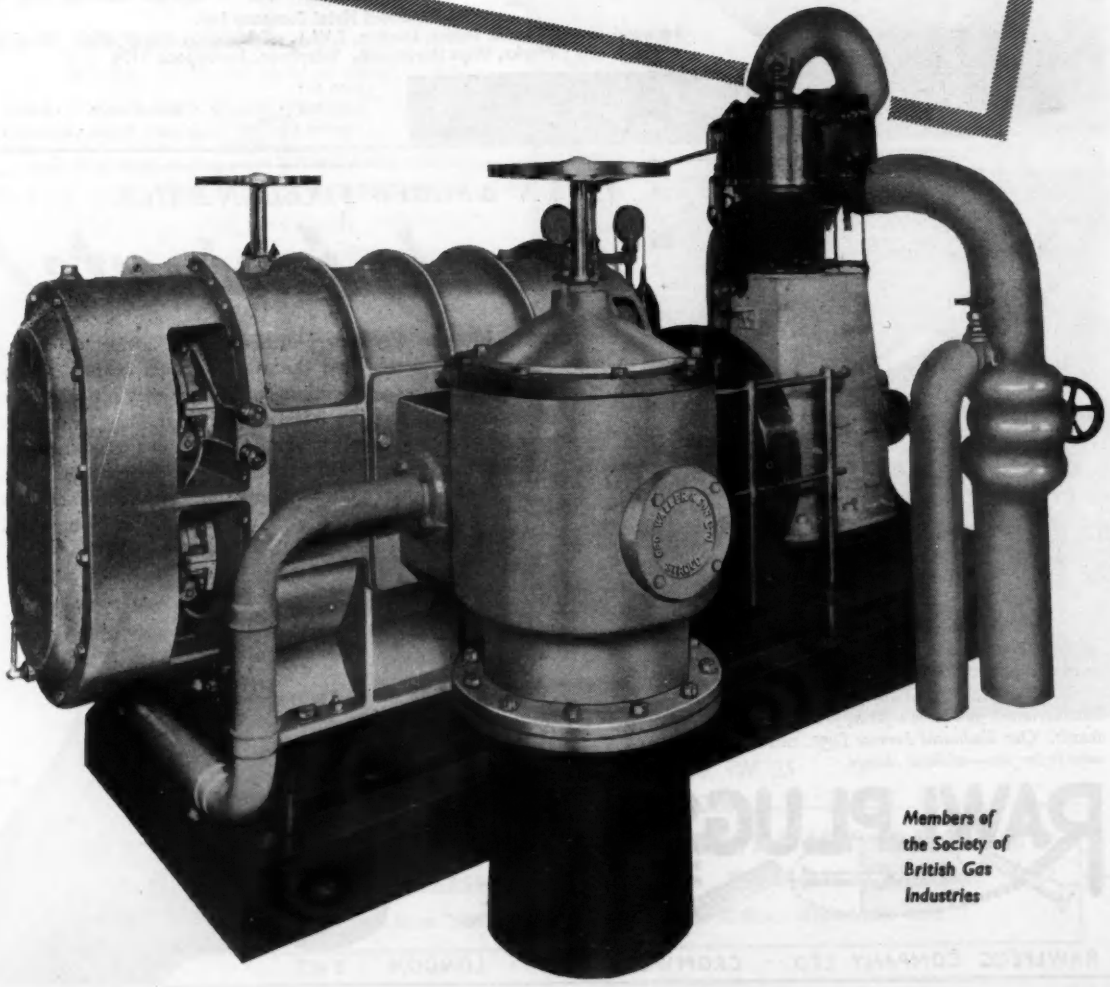

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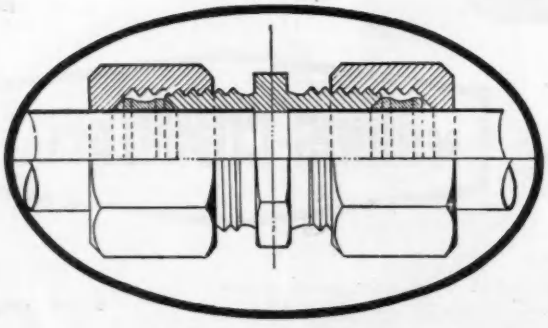

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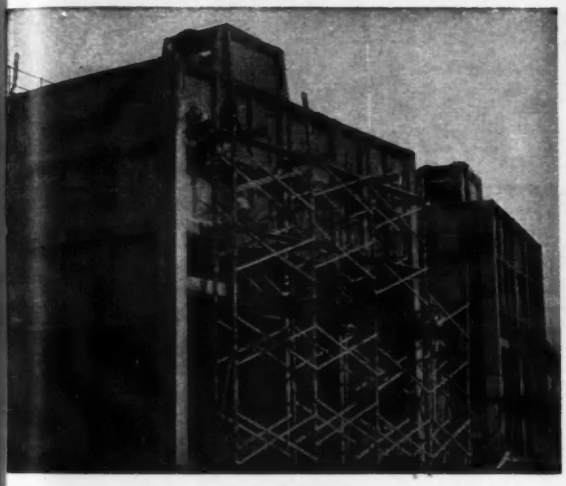

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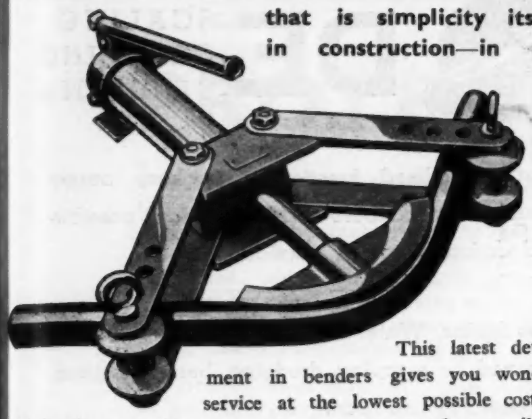

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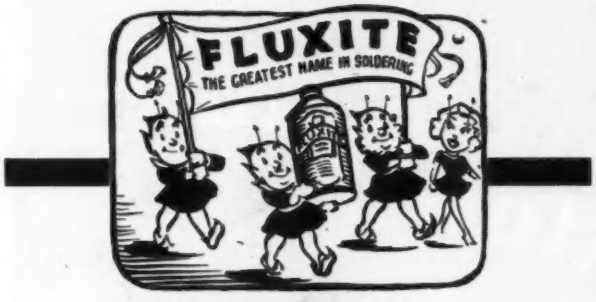

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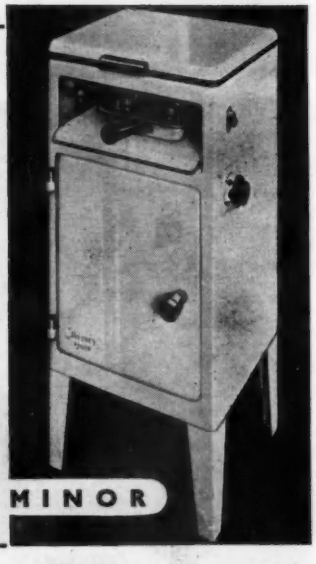

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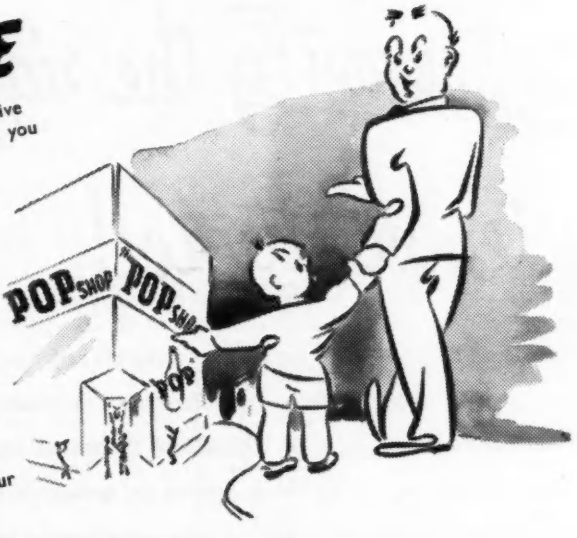

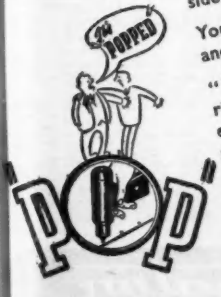

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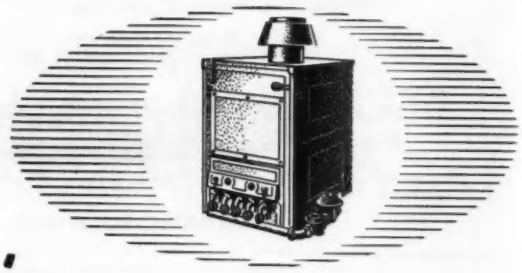

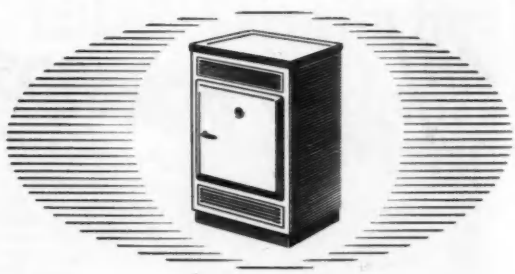

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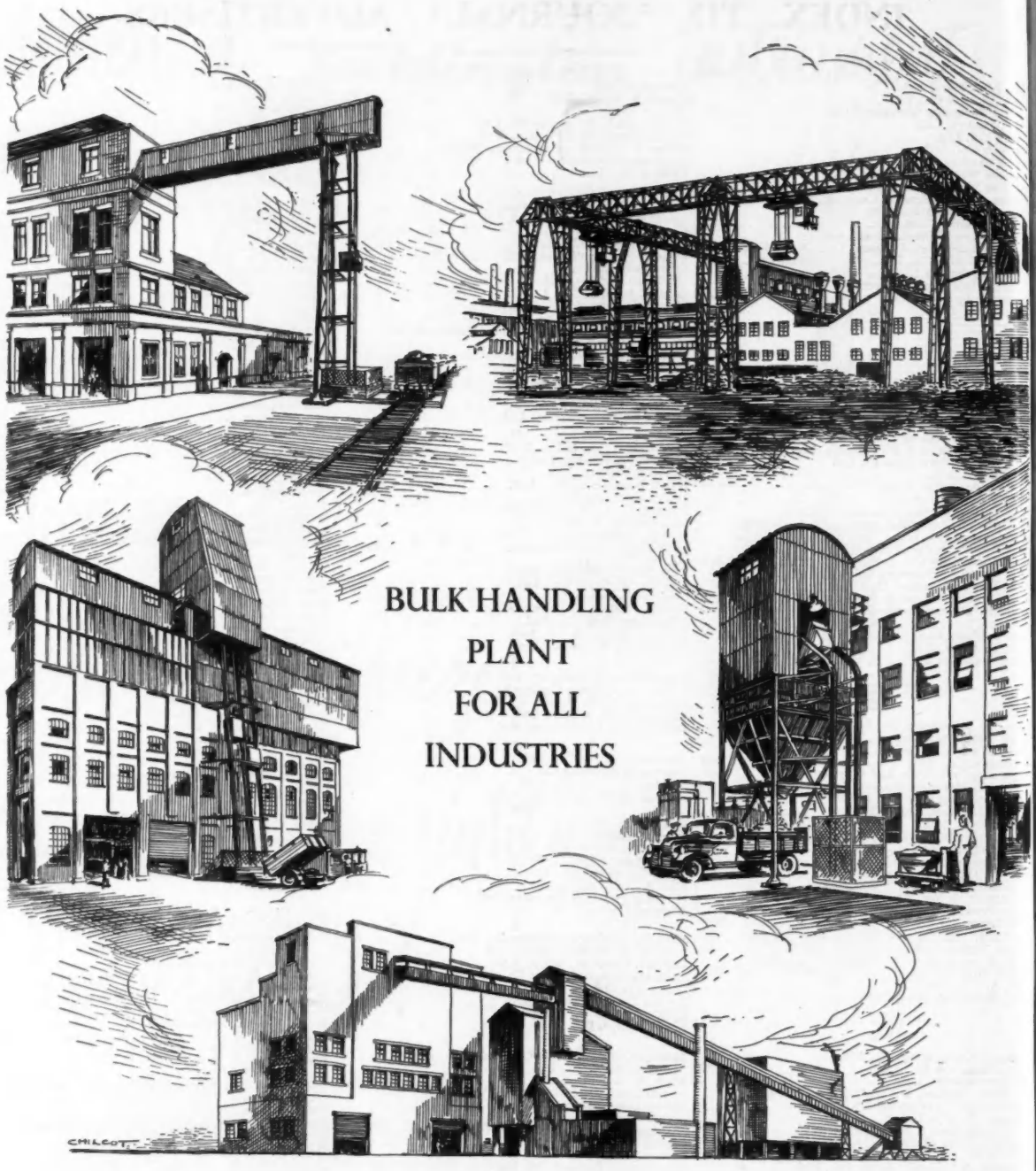

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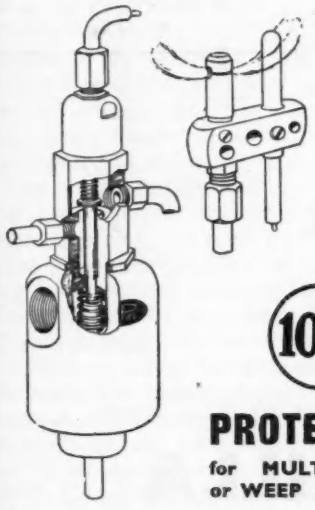

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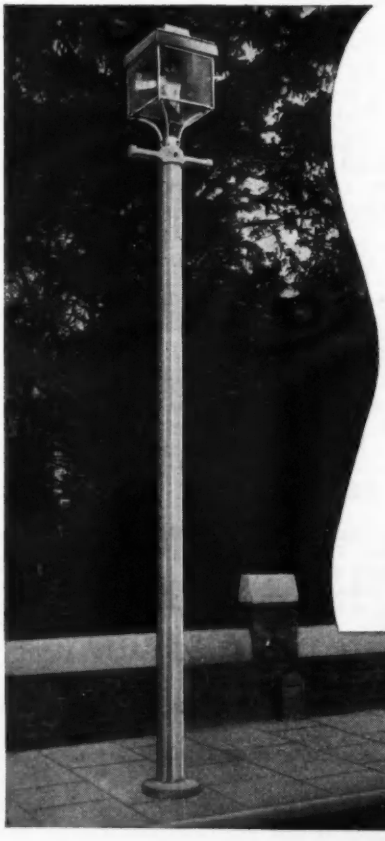

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GAS JOURNAL

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FUEL AND SOCIETY

WE have indeed travelled a long way from *laissez-faire*. In his second Presidential Address to the Institute of Fuel—the swan-song of a memorable two years in office—Dr. G. E. Foxwell followed up his 1952 essay on the technical achievements of the 18th century in the development of coal in the service of man with an equally brilliant essay on the extension of State action, interference if you will, in big industry and particularly in the fuel industries, including under the term fuel all forms of energy that are convertible into heat or power on the industrial scale. Public opinion in this country, in most other countries, and even to some extent in the U.S.A. has come round to the view that public utilities involving some form of monopoly must, 'as a purely utilitarian approach to a problem that had become increasingly evident as 19th century progress rolled on,' come increasingly under Government direction or at any rate under the control of public corporations set up under Act of Parliament. Dr. Foxwell shows that this movement is really quite independent of the political views of any particular party and that the idea of the Public Corporation dates back, in theory, to antiquity, in practice to the middle of the 19th century. Today the world-wide position is that 'collectivism in one form or another has completely replaced *laissez-faire* as the principle behind the relations of the State with industry.'

In regard to fuel the private citizen can no longer regard himself as free to waste the resources of his country. Future fuel policy must be based on the assumption that the fuel industries will remain under some form of State ownership or State-controlled corporation, *that certain large users of fuel will sooner or later be brought under some form of control*, and that the tendency will be for the principle of increased Government control to be accepted generally. These may seem hard sayings to some people. The danger is that mediocrity rather than brilliant individuality will cast its blight upon the solution of the problems before us. And grave problems *are* before us. We are drawing, as Mr. W. E. P. Johnson put it in his recent paper 'Use and Abuse of Fuels' (Royal Society of Arts), on capital savings, not living on revenue earnings. This over-riding consideration is well known to technologists and we forbear to inflict further repetition on them. The disquieting fact is that there is no sign that adequate weight is given to it in those high regions where control does and will reside. It is disturbing to find, says Dr. Foxwell, that the State, as the owner of coal, concentrates, as if it were a proposition of self-evident validity, on exporting the maximum amount of raw coal. Economists are, we should say, agreed that a country like ours should retain whatever natural resources it has, and export goods with the greatest content of labour and skill.

What then are Dr. Foxwell's proposals for the immediate future? He would not claim originality for them. Consumers should not be induced to use particular fuels except where these are the most efficient in the widest sense of the term. The same proposition in different words is that the best possible use should be made of all indigenous fuels. A yardstick, he says, is needed against which the efficiency of the nationalised fuel-producing industries can be measured. We have no doubt whatever that the yardstick should be the minimum quantity of coal (or other fossilised fuel) which can be made adequate to the purpose to which it is applied. He repeats, in a slightly different form, the Ridley Committee's recommendation with regard to tariffs. He stresses the efficiency of the carbonising process, but remarks that the gas industry seems disposed to reduce its output of smokeless solid fuel, missing the point, we think, that its first duty must be to maintain its output and extend the efficient application of smokeless gaseous fuel. He makes the obvious criticisms of the wrong-headed policies of the electricity industry.

All these points are made by Dr. Foxwell with further emphasis on the necessity to reserve, now, all remaining coking coals (and we should add, gas-making coals) to the carbonising industries. We can answer his rhetorical questions without much hesitation. Coking coals should not be exported unless under dire necessity.

These and gas-making coals should be reserved for carbonisation and the carbonising industries should be expanded to the practicable limit. These coals should be denied to consumers of raw coal for combustion purposes. High transport costs should not be an excuse for exceptions to this denial. Perhaps we might hesitate, at least long enough to give it serious consideration, whether to accept Dr. Foxwell's tentative suggestion that the fuel position is sufficiently grave to justify the appointment of inspectors of fuel utilisation with powers similar to those of smoke inspectors. Government cannot stand aside and permit waste or improper use to continue. 'There remains to us a century or so to find an adequate substitute for coal . . . The energy problem is not the only one facing us but it is probably the most important of all.'

Mr. Johnson applied himself first (in the paper already referred to) to possible economies, most of them familiar to us all, though little is being done about them. The idea that the gas turbine is a possible fuel economiser is illusory—unless use can be made of its waste heat which, as Mr. Johnson points out, is at a much higher temperature than that rejected from the steam turbine. This would not generally be the case where the gas turbine was applied to the small power units of transport. Some of his statements do not inspire confidence—*e.g.*, 'we use coal to make town gas and then allow 80% of its content to go up chimneys.' But his strong case for the greater use of oil merits more respect—to the extent that we should use oil for greater efficiency in, say, rail transport, conserving coal which is there used at a fantastically low efficiency.

We cannot here go over all the many suggestions which have been put forward for 'revenue' energy sources. They are practically all based on the utilisation at one or more removes of solar energy. Water power and wind power are obvious forms, but seriously limited by geographical situation and difficulties in transport of energy. The possibilities of intensive culture of fuel crops—timber, certain alcohol-rich plants—should be further explored. Atomic energy, we venture to think, at the risk of heresy, will not be generally applicable until nuclear fission of some such common element as hydrogen, in practically unlimited supply, is developed without the emanation of dangerous radioactive by-products.

Both the thinkers whose reflections we have to some extent analysed are agreed that their projects call for considerable expenditure. Planning must be bold and reasonably long term. 'Had we gone forward with the Severn Barrage in the early 1930's the project would now have been . . . highly profitable.' Had we taken full advantage of the 1920 Gas Act, should we have more of our best gas-making coals still to use?

INTERMITTENT VERTICALS

THE original vertical retort arose by way of the inclined retort out of the desire to let gravity do the work. In his paper 'Intermittent Vertical Chambers, Past, Present and Future,' presented to the Wales and Monmouthshire Section of the Institution of Gas Engineers—see p. 431, Mr. R. W. Crowther traced briefly the origins of the intermittent vertical retort and described in some detail the interesting system which is now being designed and developed by his company, W. J. Jenkins, & Co., Ltd.

Steaming has from the first been practised in the intermittent vertical retort with the difference from steaming in the continuous vertical retort that it, too, is intermittent. It is limited to a very few hours after carbonisation is more or less complete and the calorific value of the added gas rapidly falls off. The residual coke is discharged hot, and though attempts to recover this heat have met with some success it cannot be said to be very impressive. On the other hand, the density and strength of the coke made with a given coal are greater than in the continuous vertical.

Mr. Crowther called attention to two main features of what has been known as the Jenkins-Klönne system. The construction of the bottom discharging door is ingenious. It would seem to be an excellent arrangement for taking gas away, for economising pad breeze, and for the admission of steam. We take it that the water-sealed type of door is giving way to the self-sealing, metal-to-metal design in cast steel. Steaming in this system is either upward or downward. More detail of results obtained with the two methods would be interesting. The reference in *King's Manual*, Section 2, p. 59, is: 'Steaming in this system is downwards (though upward steaming is also arranged for), and it is claimed that the calorific value of the added gas is better maintained and that scurf formation is reduced.'

But more emphasis is laid on the design and construction of the refractory work of the chambers. This will be studied with interest by carbonising engineers. They will scrutinise such expressions as providing the correct expansion allowance in the periphery only of the setting. The idea of the 'continuous binder' method of chamber wall construction will excite considerable interest. The estimation of expansion allowance and the positioning of it to take account of the relative movement of the chamber and the setting walls is one of those problems which call for the maximum of experience and judgment based, of course, upon a full knowledge of the properties of the materials in use.

Mr. Crowther's reflections on the future of I.V.R. will be attended to with respect. This type of plant shares with other intermittent systems where the inlet and outlets of the carbonising vessel are open, the disadvantage of emission of smoke at charging and of steam in the quenching of the coke. No doubt these disadvantages are not insurmountable. It is a pity that for the time being the development of the 'enclosed intermittent' appears to have come to a standstill. In the direction of thermal efficiency the use of metallic recuperators is said to be promising. The self-clinkering step-grate producer crops up now and then but it will be surprising if in the long run the step-grate will hold its own against the very rapid development of pressurised mechanical producers which is now taking place. There is one possible development which we think will not be in the interests of the gas industry in this country, that of the adoption of so-called 'combination' heating—or compound heating—on the lines of coke oven practice. It was shown at Southall that there is plenty of flexibility in the intermittent vertical retort without using coal gas for the heating of settings.

The future of the intermittent vertical and possibly that of the coke oven is more likely to be assured by their adaptability to blending technique. Mr. Davies

called attention to this in his excellent contribution to the discussion. When the present wastage of coking coals renders it necessary to blend with non-coking varieties it must be borne in mind that blending involves breaking down to ⅛ in. as well as intimate mixing. Coal so fine as this would so slow down the operation of the continuous vertical that it might no longer be remunerative—the continuous vertical might lose its present position as the most efficient method of making town gas. It must not be forgotten, however, that blending will not make up for high ash content. It is difficult, indeed, as Mr. Wright put it, to make a suitable coke from cheap coals. If the gas industry is to remain a two fuel industry, may it not be driven to clean its own coals as well as blend them?

Other points in Mr. Davies' contribution are worth attention. The self-sealing, metal-to-metal, bottom door renders practicable the application of airborne sealing to the maintenance of retort tightness—interesting evidence that the worth of this method is recognised outside its original sphere. Again the question is raised whether the retort-house building is really necessary. It would certainly be very seldom necessary to compete with the architecture of the adjacent cathedral, but it must not be forgotten that not only have the amenities of the neighbourhood to be considered but those of the operator as well. He needs protecting from the wind and the rain.

DESIGN OF CONDENSERS

ALTHOUGH a great deal of work has been done on the theory of condensers, or rather on the cooling of such mixtures of permanent gases and vapours as crude coal gas, it will be admitted that the design of gasworks condensers has been based upon experience rather than theory. Indirect water cooling with the gas circulating around water tubes had become standard practice in this country. More or less empirical rules prescribed the necessary area of cooling surface per million cubic feet per day, which was modified to suit the temperature of the hot gas, and experience had revealed differences between the several arrangements of water tubes and gas passages in the different designs. Mr. Ralph Pollard, Research and Development Engineer to R. & J. Dempster, Ltd., in a paper presented to the Manchester Juniors last month and excerpts of which we publish in today's *Gas Journal*, recounts that Colbourn and Hougen published a comprehensive paper in 1934 on this subject but that it is only recently that Mr. Redman, of the North Western Gas Board, has shown the application of this data to gasworks practice.

It is evident that many other factors besides the heat content of the gases and vapours enter into the calculation of area of cooling surface and water consumption. Even the heat transfer coefficient varies widely over different points in the surface and these surfaces may become scaled or otherwise fouled. Generally these variations have been covered by a generous provision both of surface and water. But as water becomes more costly and space more valuable, there is obvious advantage in getting nearer to the requirements definitely called for.

It was in order to test the new methods against practical results that arrangements were made between R. & J. Dempster and their neighbours, West's Gas Improvement Co., Ltd., to install two standard types of condenser in the latter's experimental gasworks, where fortunately one 50-in. vertical retort was in operation. The advantages of this arrangement were that a relatively small quantity of gas was available, readily measurable, with practically constant composition and yet a sufficient quantity to permit tests to be carried out of apparatus which though of small size and low cost was large enough to represent full-scale working.

We have reproduced the essential details of the tests in the two types of apparatus chosen together with the sketch-drawings of them. Mr. Pollard's paper contains the working-out of the formulæ used and is illustrated by a number of graphs. Of the methods used that of Colburn and Hougen gave him the greatest satisfaction. A complete study of the subject will be facilitated by the moderate bibliography appended to his paper, although we fear it is optimistic to suggest that 'the original papers may be consulted at any good technical library' or at least to suppose that there are many libraries as good as that. Mr. Pollard's paper itself cannot fail to be of immense interest to those engaged in the design of gasworks condensers.

Letter to the Editor

THE CHOSEN FEW

DEAR SIR,—I have read your remarks entitled 'A Grave Injustice' in your issue of April 29, and the letter which prompted them, and am surprised that this grievance has not been ventilated before. It is, of course, quite true—at least it has always been assumed to be true—that competition brings down prices, and it is disquieting to learn that one of our national industries thinks differently.

There is, however, another abuse that springs from this departure from ordinary commercial practice, because if the gas boards confine their enquiries to a chosen few, it is not difficult to imagine the efforts, involving much expenditure of time and money, which manufacturers make to become one of the few—and must make, as there is no other way of finding out when new plant is wanted and where.

Public advertisements would at least solve that difficulty and in doing so should enable manufacturers to make a certain reduction in their overhead expenses, which would be reflected in the quoted price. There is no doubt that the current policy of the gas boards leads directly to inflated prices and is costing the country a lot of money.

Yours faithfully,
MANUFACTURER.

May 12, 1953.

GASWORKS ASSESSMENTS

LEVEN TOWN COUNCIL has been informed that the rateable value of the gasworks this year will be down to £1,766. Four years ago, prior to nationalisation, the undertaking was valued at nearly £9,000 for rating purposes—and it has expanded since. The new figure is £231 less than last year. A letter from the Assessor of Public Undertakings explained that the drop was due to a general decrease in the cumulative valuation of the Gas Board's property, along with the fact that structural costs throughout Scotland were up.

One member of the Council said they were just being used to safeguard the profits of the Scottish Gas Board and another said it was difficult to appreciate how the value of the undertaking could deteriorate when the place had been expanding. It was hard to think that the gasworks, built up by Leven and the neighbouring Town Council of Buckhaven and Methil as a grand capital asset for the ratepayers of both boroughs, should now be used to penalise them in this way.

It was agreed that, although it was too late to do anything in the matter this year, Mr. J. Henderson Stewart, M.P. for East Fife and Scottish Under-Secretary, should be asked for assistance, and other local authorities who had suffered at the hands of the Public Assessor should be contacted with a view to presenting a united front against such decreases in future.

Personal

The Minister of Fuel and Power has re-appointed the following Chairmen of Gas Consultative Councils: *Scottish*, COUNCILLOR A. T. MORRISON, C.B.E., J.P. *Northern*, ALDERMAN J. HOY, B.E.M., J.P. *North Western*, ALDERMAN C. E. P. STOTT, J.P. *North Eastern*, COUNCILLOR W. REGAN, J.P. *East Midlands*, ALDERMAN C. R. BATES, O.B.E., J.P. *West Midlands*, ALDERMAN W. H. MALCOLM, J.P. *Wales*, ALDERMAN G. F. HAMER, C.B.E., J.P. *Eastern*, ALDERMAN R. TURNER, J.P. *North Thames*, COUNCILLOR E. BAYLISS, D.L., J.P. *South Western*, COUNCILLOR A. W. LOVEYS.

Obituary

MR. R. H. G. BARNARD, for 26 years Manager of the Wantage Gas Department, a position he relinquished in 1946 through ill-health, has died at the age of 72. Before going to Wantage he was with the Swindon undertaking, and before that at Winchester. Mr. Barnard leaves a widow and two sons.

MR. ALFRED PILLANS, Manager of the St. Anthony's by-product works of the Newcastle Division, Northern Gas Board, died on May 7 at the early age of 42. He joined the staff of the former Newcastle and Gateshead Gas Company in August, 1946, as senior chemist, having previously been in the service of Monsanto Chemicals, Ltd., at their Wear tar works. On the retirement of Mr. S. A. Wikner in March, 1949, Mr. Pillans succeeded to the managership of the works and was at the time of his death actively engaged in substantial plant extensions.

MR. CYRIL BLAKEY, Commercial Manager of Radiation Group Sales, Ltd. (Solid Fuel Division), since its formation in 1950, died on April 29, aged 56. Mr. Blakey was formerly Sales Manager of Wilsons and Mathiesons, Ltd., Leeds, which company he joined from the Carron Company, Falkirk, in 1924. He will be missed by a wide circle of friends in the ironfoundry industry and among builders' merchants. A first class all-round sportsman, he was in earlier days in Scotland a cricketer of note, a seeded player in North of England tennis tournaments and, latterly, a keen golfer.

The Carbonisation Department of the National Coal Board now has its headquarters at Hobart House, Grosvenor Place, London, S.W.1. (Telephone: SLOane 3401.)

French Week.—The municipality of Harrogate, Britain's largest inland spa, organised for the week May 10 to 16 a 'French Week,' providing a civic link with the renowned French spa of Luchon. One of the aspects of French life which was demonstrated during the week was cookery. The demonstrations were held in the North Eastern Gas Board's Harrogate showrooms. Lectures under the title of 'An Introduction to Gastronomy' were given by M. Robert French Gastronomy' were given by lecturer at Leeds University. During the preceding week Mdme. Saint-Père gave advice and demonstrations to York/Harrogate Group home service advisers, who repeated some of the recipes which they had tried out.

Ben Hittinger

THE *Ben Hittinger*, one of National Benzole Company's fleet of motor vessels, will take part in the Coronation Naval Review on June 15. She was launched in May, 1951, by the Chairman of National Benzole Co., Ltd., Mr. A. Hittinger.

Powered by a British Polar M.46 I type Diesel engine, developing 560 b.h.p. at 375 r.p.m., the *Ben Hittinger* obtained a speed of 10¼ knots on trials. She is 160 ft. overall length, 27 ft. 6 in. beam, and with a draught of 11 ft. 6 in., and has a carrying capacity of 500 tons of cargo, which is exclusively motor spirit. This cargo is carried in eight tanks. The vessel operates on the East Coast and is commanded by Captain J. L. Gardner, who joined the company in July, 1946, as second mate.

Public Lighting Engineers

THE ANNUAL CONFERENCE of the Association of Public Lighting Engineers will be held at Liverpool from September 15 to 18 inclusive. Many members have indicated their intention of being present and delegates from local authorities and gas and electricity boards are being appointed.

An interesting programme has been arranged and papers dealing with various aspects of street lighting will be given. At an exhibition to be held in St. George's Hall opposite the Picton Hall, in which the conference sessions are to be held, members and delegates will inspect apparatus and equipment displayed by well known manufacturers. The exhibition will be opened by the Lord Mayor of Liverpool. In St. John's Gardens there will be displayed various types of steel and concrete lamp columns, bollards, etc. A further feature will be tower wagons, syphon emptying outfits, extending ladders, etc.

Nalgo

THE ANNUAL DINNER of the National and Local Government Officers' Association was held on Friday last in the Members' Dining Room, House of Commons, the President, Mr. W. Strother, in the chair.

'Whitleyism' was proposed by the President, who spoke of the value of collective bargaining and joint conciliation as working alternatives to haphazard and unsatisfactory methods lacking in friendship and understanding. Response was made by Sir Walter Monckton, Minister of Labour and National Service, who struck a similar note in his emphasis on the determination of problems through tolerance.

The toast of 'The Public Services,' proposed by Mr. T. Nolan, Senior Vice-President of the Association, was replied to by Mr. H. F. H. Jones, M.B.E., Deputy Chairman of the Gas Council. The other toasts were 'The National and Local Government Officers' Association,' proposed by Dr. W. A. Robson, Professor of Public Administration, London University, and responded to by Mr. A. E. Odell, Vice Chairman, National Executive Council; and 'Our Guests,' proposed by Mr. L. H. Taylor, Junior Vice President, and replied to by Sir Howard Roberts, C.B.E., Clerk of the London County Council.

Birkenhead Town Council has decided to take over the responsibility for the maintenance of gas lighting in the district from the North Western Gas Board on the grounds of economy. It was stated by Alderman H. Platt that last year the Corporation paid the Gas Board £10,200 for maintaining street lighting by gas, and they were now informed that from June 1 the cost would be increased by £4,800. Corporation officials maintained that the work could be done by them far more cheaply. The work was carried out by the Corporation before nationalisation.

DIARY

May 27.—SOUTH WESTERN SECTION, I.G.E.: 'Some Attempts Made to Reduce the Cost of Gas Production,' J. E. Wilkes and J. A. Bell. Taunton.

May 28.—EAST MIDLANDS SALES AND SERVICE CIRCLE (Sheffield and Rotherham Division): Visit to Rainhill Works of Stoves, Ltd.

May 28.—NORTH THAMES G.C.C.: Westminster City Hall, Charing Cross Road, W.C.2, 2.30 p.m.

May 29.—SCOTTISH JUNIORS: Joint Visit to Whessoe, Ltd., and to the new factory of Paton & Baldwins, Ltd., Darlington.

May 29.—LONDON JUNIORS: Annual General Meeting, Lecture Theatre, 178/180, Edgware Road, W.2, 6.30 p.m.

May 30.—WESTERN JUNIORS: Visit to Stapleton Road Works. 'Fluids Handling on Gasworks,' J. Parker. Bristol.

June 6.—SCOTTISH (EASTERN) JUNIORS: Annual Outing. Galashiels.

June 6.—SCOTTISH (WESTERN) JUNIORS: Ladies' Day: Visit to Loch Katrine and Royal Lodge.

June 8.—SOUTH EASTERN G.C.C.: Caxton Hall, Caxton Street, Westminster, S.W.1, 2.15 p.m.

June 8.—NATIONAL AND LOCAL GOVERNMENT OFFICERS' ASSOCIATION (Nalgo): Meeting of Gas Staffs, Llandudno, 9.30 a.m.

June 9-12.—NATIONAL AND LOCAL GOVERNMENT OFFICERS' ASSOCIATION (Nalgo): Conference, Pier Pavilion, Llandudno.

June 10.—SOUTHERN G.C.C.: Bournemouth, 11 a.m.

June 10.—SOUTH WESTERN GAS CONSULTATIVE COUNCIL: Meeting, 34, Bridge Street, Taunton, 11 a.m.

June 11.—MIDLAND JUNIORS: Ladies' Day, Hereford.

June 15-16.—EASTERN SECTION, I.G.E.: Annual General Meeting, Royal Hotel, Clacton. Chairman's Address, F. A. Rhead; business meeting; 'The Case for the Deep Purifier,' R. Whiting, Divisional Engineer, Ipswich.

June 17.—LONDON AND SOUTHERN SECTION, I.G.E.: Summer Meeting, Brighton.

June 20.—MANCHESTER JUNIORS: Ladies' Day at Windermere. Bus ride to Langdales or visit to Gasworks optional.

June 20.—LONDON JUNIORS: Ladies' Day and Summer Visit to Cambridge.

June 20.—WALES JUNIORS: Summer Meeting and Ladies' Day: Visit to Whitland butane/air gas plant, followed by lunch, Royal Gate House Hotel, Tenby.

June 25.—NORTH THAMES G.C.C.: Caxton Hall, S.W.1.

June 27.—WESTERN JUNIORS: Summer Meeting and Ladies Day.

Gas Industry Productivity Team's Report

Lessons from America

The report of the Productivity Team of 16 representing the British gas industry which visited the United States last year under the leadership of Mr. J. H. Dyde, Deputy Chairman of the Eastern Gas Board and at that time President of the Institution of Gas Engineers, was published on May 11.

AT a Press conference preceding publication of the report Mr. Dyde said the team realised from the outset that the great expansion of the American gas industry during the last decade consequent on the exploitation of natural gas resources would make direct comparison with our own industry in many ways impracticable. Nevertheless that rapid expansion had of itself produced problems in the distribution and storage of gas and in peak load sales which were likely to prove of value to the British gas industry. We should also gain from first hand knowledge of American experience in the production of gas from petroleum distillation products.

The report says that in terms of productivity the team found no evidence that the American gas workers as a whole were actually working harder than their British counterparts. The gas manufacturing and distributing industry, by its very nature, did not lend itself to incentive schemes. With a few exceptions, notably payment on a commission basis to salesmen, no payment-by-results schemes were encountered. It was the view of the American industry that increased productivity, where it had occurred, was due to improved techniques rather than to increased effort. Mechanical aids as well as techniques not employed in Britain are used in America to accelerate main and service laying operations. Generally their application is directed towards reducing manual excavation and the area to be reinstated and towards dealing with circumstances where physical obstacles are a difficulty or traffic congestion presents a problem. Widespread use is made of mechanical devices for handling and storing appliances, thus reducing heavy manual work to a minimum.

Manufacture of gas from coal, coke, and oil in the American gas industry has declined, and now contributes about 5% of the total gas sales. In Britain 99.7% of the total gas sold is manufactured gas. The American gas industry produces only 330 mill. therms of coal gas, or 0.7% of the total therms sold, while in Britain the gas industry produces 2,000 mill. therms of coal gas, equivalent to 74% of the therms sold. Furthermore, in the States, the coal is carbonised almost entirely in coke ovens, while in Britain only a small proportion of the coal used by the gas industry is so carbonised.

Carburetted water gas was used to a great extent in America prior to the receipt of natural gas, but relatively little is made now. Valuable technical information was acquired concerning the intensive efforts that were then made to obtain maximum outputs from carburetted water gas plants, and the use of the cheaper heavy fuel oils.

Liquefied petroleum gases (propane and butane) are becoming available from the expanding oil refineries of this country, and their use by the gas industry in Britain, based on American experience, presents potentialities, subject to satisfactory terms of purchase and to long-term security of supplies. The report indicates the direction in which developments are foreseen, and affirms that they can provide a useful contribution to coal economy. Suitable plant, equipment, and transport should be made available by manufacturers in Britain, and a standard code of practice prepared covering design, installation, and plant operation, with special regard to fire and explosion hazards during transport and in storage plants.

Distribution

Considerable feats of engineering skill and ingenuity have gone into piping natural gas at very high pressures (800 lb. per sq. in.) across the continent of North America. Main lines of over 1,800 miles in length have been laid with a number of intermediary re-pressurising stations. Some of the techniques evolved in the design and construction of these long distance transmission systems would become of value with the further extension of gas-grids in Britain.

All gas utilities visited undertook what is known as a 'leakage survey' of their distribution systems. It is claimed that by this procedure unaccounted-for gas is reduced, consumers' complaints of gas escapes are drastically curtailed, relations with consumers, other utilities, and local authorities are improved, and a steep rise in the insurance premiums covering public liability has been halted. Some such procedure is worthy of further examination in the light of conditions in Britain, with particular reference to built-up and subsidence areas.

Perhaps the most important feature that came to light in the study of American gas distribution practice was that of applying special measures for protecting mains and services against corrosion to secure greater life. A great deal could be accomplished in Britain towards extending the life of underground plant by adopting American methods of cathodic protection. This could provide not only a saving in material *per se* but would lead also to an increase in the use of steel in place of cast iron with a consequent reduction of some 50% in the use of raw material. It is claimed that a comparatively lightweight steel tube can be given a useful life of 60 years by relatively inexpensive cathodic protection.

Utilisation of Gas

During 1951 over 1 mill. domestic consumers in America installed gas-fired installations for the complete space-heating of their homes—in addition, 2 mill. gas water heaters and 3 mill. new cookers were installed. Another popular gas-heated appliance was the rotary clothes-drier, which, when used in conjunction with a washing machine, enables the family laundry to be dried quickly and satisfactorily.

In America the large bulk of appliances are sold through dealers who also undertake the installation and servicing work, the utilities acting for the most part in an advisory capacity and assisting in the training of sales and service personnel. Sales of approved appliances by dealers should be encouraged in Britain as leading to an extension of goodwill and of the public's knowledge of the service gas is able to offer. In the States, domestic appliances are retailed at makers' standard list prices, and the standardisation of retail prices in Britain would be a step in the right direction.

Industrial Relations

Direct and friendly relationships were deliberately fostered by the American gas employers between themselves and individual employees; the staff were kept closely informed of their company's policy and general affairs through the medium of these direct relationships, and the novel application of publicity methods. These factors contributed to a greater sense of mutual responsibility. In Britain the adoption of similar measures where they do not at present operate would strengthen the work and enhance the success of proved joint consultative machinery.

Conditions of service in the American and British gas industries are comparable. In the States, however, common conditions of service were shared between both manual and clerical workers, due to the fact that no traditional division of status existed between these types of work.

In common with other productivity teams the gas team noted the emphasis placed on education for management, which usually comprised appropriate courses for all supervisory and management personnel ranging from the level of foreman to that of vice-president of a company. An extension of the conference (or syndicate) principle for training in the techniques of management appropriate to the various grades within the British gas industry is recommended.

Although research in the American gas industry is being undertaken over a wide field, two subjects appear to predominate, and both are associated with the rapid expansion in the use of natural gas. The first is the extensive work undertaken in regard to the effect of the admixture of gases of differing combusion characteristics on the behaviour of appliances. The second relates to the discovery of other sources of supply against the time when supplies of natural gas begin to diminish. A parallel problem exists in Britain inasmuch as the reserves of the best gas-making and coking coals are a diminishing asset, and gas must accordingly be produced from other grades of coal or from other sources. It would therefore be an advantage if permanent and close liaison could be maintained between the gas industries in both countries.

Copies of the Report (8s. 6d., post free excluding air mail) are obtainable from the British Productivity Council, 21, Tothill Street, S.W.1, and from the Gas Council.

NORTH THAMES SALESMEN AT MAINS

CONTINUING the series of visits by sales and service representatives of the North Thames Gas Board to the Edmonton factory of R. & A. Main, Ltd., the Salesmen's Circle of the Central Division recently made a tour of the works, occupying a whole morning and afternoon. At luncheon, the party was welcomed by Mr. C. A. Macleod, Sales Director, R. & A. Main, Ltd., who said how pleased they were to receive visits from all the various sales organisations of the gas boards. Mr. Macleod recalled incidents arising out of the long association between the old Gas Light and Coke Company and Mains, including a period in the 90's when Main cookers were delivered from door-to-door by horse and cart.

After the war they carried out a great deal of research work in collaboration with Watson House. The result was seen in the 'London' cooker, the finest value in cookers on the market today, and one which was combating electrical competition.

Thanks were expressed to R. & A. Main, Ltd., for their hospitality by Mr. E. R. A. Foreman.

Freedom of Choice

BY eight votes to five, the Housing Committee of Edinburgh Corporation recently decided that in future the Corporation provide only gas and electricity points in new dwelling-houses, the tenants being free to make their own arrangements with regard to the installation of cooking stoves.

When Bailie James Campbell's amendment that the Corporation should continue to supply gas cookers as part of the fitments of new houses was defeated, he moved that the matter go to the Town Council. This was approved. The committee had before it communications from the Gas Board and the Electricity Board relating to the supply of these appliances to tenants.

Bailie Campbell said they should enter into negotiations for more favourable terms for tenants than were offered by the gas and electricity boards. Councillor Murray, Chairman, said that for some months he and conveners and officials had been making enquiries relative to the possibility of gas cookers being hired or some other system which would avoid the Corporation taking them in with the purchase of houses.

Bailie Campbell asked who had authorised them to open negotiations. The Chairman replied: 'Bailie Campbell is not being in the last helpful.' Bailie Campbell said he was going to be obstructive if there was any move to reduce the standard of housing in Edinburgh. Bailie J. B. Mackenzie said he wanted to correct Bailie Campbell on the point that somebody wanted to lower the standard of housing conditions. The whole root of this was to lower the rent of houses. The aim was to vary the financial implications of supplying cookers in such a way as to reduce the cost of houses. There was no question of having an inferior type of gas or electric cooker.

He stressed the point that tenants should have a free choice—gas or electricity. The offer made by the Electricity Board would mean that tenants of new houses would have to pay 62s. 6d. per annum while, at the present time, there were in Edinburgh hundreds of electric cookers hired at 30s. a year. They could not agree on the Housing Committee on such an anomaly taking place in Edinburgh.

Replying to a frequently stressed point that the best scheme possible should be obtained for tenants, Councillor Murray said that each of these authorities knew that the other was in competition with them and he had no doubt that they had taken that into consideration when they made their present offers.

At a Recent Meeting of the Ludlow Rural District Council it was reported that the Midlands Electricity Board would withdraw its request for a contribution of £100 for services to the 22 houses to be built at Craven Arms if gas cookers and boilers were installed, provided the Council would give the tenants the choice of gas or electricity. At the previous meeting members had criticised the Midland Electricity Board's request, and had referred the matter of the type of cooker back to the Housing Committee with instructions to fight the request. Mr. E. Shaw, the Engineer, reported that the West Midlands Gas Board was willing to enter into open competition with the M.E.B. on the site in this case. The Council agreed to the Electricity Board's request.

Wales Gas Staffs at Porthcawl

MR. T. MERVYN JONES, Chairman of the Wales Gas Board, stated at a recent week-end school, run by the British Gas Staff Association, that during the last 16 months Wales had shown a greater rate of expansion in selling gas than any other gas board area. In touching on the installation of the grid system of supply, he assured those present that as a result the Gas Board expected not to supplant, but greatly to expand, the existing staff and gas sales. The gas industry had a tradition of joint consultation, and his Board would always do all it could to foster good relations with the trade unions, so that the management could carry out adequately their duties both to those within the industry, and to the world outside.

The school was attended by delegates from the B.G.S.A. from all parts of Wales. The object of the school was to educate gas staffs in the methods of joint consultation and towards a better understanding of the mutual difficulties experienced by both management and employees in providing adequate rewards for serving the industry and the general public.

Other speakers at the school were Mr. R. S. Snelling, Deputy Chairman of the Wales Gas Board, who spoke on 'Industrial Relations and Board Policy,' and Mr. W. E. Crowley, Industrial Relations Officer of the Wales Gas Board. Mr. W. J. Griffiths, Industrial Relations Officer, Wales Office, Ministry of Labour and National Service, gave a lecture on 'State Provisions for the Avoidance of Trade Disputes.' Mr. W. H. Franklin, President of the National Union of Railwaymen, lectured on 'Chairmanship and the Conduct of Meetings,' and Mr. F. Moxley, Editor of the *Railway Review*, on 'Trades Unionism Today.' Finally, the chief officers of the trade unions spoke to the delegates on the internal affairs of the B.G.S.A.

Fuel Policy Overdue

MR. J. F. RUST, Chairman of the Newport Group Committee of the Wales Gas Board, and General Manager and Engineer of the Newport undertaking, has been elected president of Newport Chamber of Trade. In his presidential address he advocated a national fuel policy which he said was long overdue. Under such a policy fuel most suitable for the job in hand would be used with the greatest efficiency. Coal, the greatest remaining national asset, was rapidly diminishing, and the country could not afford to use it in the prodigal manner of the past.

All coal, if suitable, should be carbonised to produce smokeless fuel, thereby recovering all the valuable by-products. This policy would also eliminate the smoke nuisance. Half of the 2,400,000 tons of smoke and 570,000 tons of ash discharged into the atmosphere each year came from domestic chimneys and other small users of solid fuel. Smoke should and could be abolished.

Speaking of the development of the gas industry, nationally and locally, he said Newport had progressed rapidly as a result of the foresight of those responsible for public utility services. Newport undertaking had played its full part in the growth and development of the town.

EASTERN SECTION VISITS CHAIRMAN'S WORKS

MEMBERS of the Eastern Section of the Institution of Gas Engineers found much of interest when visiting the Peterborough works, Cambridge Division, Eastern Gas Board. The party of 60 included the following officials of the Eastern and East Midlands Gas Boards:—Mr. J. Hunter-Rioch (General Manager, Cambridge Division), Mr. T. C. Battersby (General Manager, Watford Division), Mr. Bernard Clarke, M.B.E. (General Manager, Lincolnshire Division, East Midlands Gas Board), Mr. D. B. Parkinson (Eastern Area Liaison Engineer), and the engineers of Tottenham, Cambridge, and Norwich Divisions, Eastern Gas Board, Messrs. E. O. Rose, E. H. Winch, and E. Williams.

The visitors made a comprehensive inspection of the works, and found the new Power Gas water gas plant of especial interest. The plant, which is fully automatic, hydraulically operated, is fitted with annular and waste heat boilers, and has a nominal output of 2 mill. cu.ft. per day, and was put to work in December, 1952. Particular attention was drawn to the counter-flow oil injection system in a chequerless carburettor of modified form. Provision has been made for the installation of a second Power Gas unit of similar size. A.C. and D.C. electric blowers are provided, capable of serving the present and future unit.

The vertical retort installation which was completed in 1944 has an effective daily capacity of 3 mill. cu.ft. of 500 B.Th.U. gas. For coal gas, conventional steam driven Connersville exhausters are used, while electrically driven turbo-exhausters deal with the water gas. To enable an interchange of coal and C.W.G. gas streams between steam and electrically driven exhauster sets, a specially adopted Bryan Donkin governor is being fitted. One set of oxide purifiers of 4 mill. capacity per day was completed in 1951, while its fellow 1½ mill. capacity per day is more than 50 years old. Water treatment is effective in a Neckar lime soda plant, with a capacity of 1,250 gal. per hour, soon to be replaced with lime soda plant of 3,000 gal. capacity by Filtrators, Ltd.

Members of the Eastern Section of the Institution of Gas Engineers with their Chairman, Mr. F. A. Rhead, at Peterborough Gasworks.

Many other features of the works were pointed out by the guides, and the appreciation which was everywhere evident was voiced by Mr. Bernard Clarke. The Chairman, Mr. F. A. Rhead (Engineer and Manager, No. 3 (Peterborough) Group, Cambridge Division), replying, said that the credit for the excellent state of the works was in a great measure due to the unfailing and liberal support which had always been forthcoming from Mr. Hunter-Rioch and to the keenness and enthusiasm of all who were employed in any capacity at the Peterborough works.

New C.W.G. Plant at Coleraine

THE installation of a 500,000 cu. ft. per day Tully carburetted water gas plant at the gasworks of the Coleraine Borough Council has now been completed and the plant has been put into operation.

The unit has been designed and constructed by Tully, Sons & Co., Ltd., to the specification of the Council's Gas Engineer and Manager, Mr. W. R. Armstrong.

The layout of the plant conforms to Messrs. Tully's standard design with additions and modifications to suit local conditions. The plant consists of the usual generator, carburettor, superheater, and washbox. The plant is mechanically operated by means of a Tully No. 1c mechanical operator which is of the positive acting common camshaft type. Two centrifugal air blowers have been supplied, one electrically driven and the other steam driven. The gas cooling equipment consists of a washer scrubber of Messrs. Tully's usual design. A tar separating tank is included in the arrangement.

An interesting technical point is that the air pressure in the blast main is controlled so that it is lower than the gas making pressure in the generator. This practice is adopted on all water gas plants of Messrs. Tully's design and ensures that air does not leak into the generator in the event of any blast valves seating incorrectly. The blast valves are designed to incorporate an automatic purge valve in the body of the main valve and in addition an automatic purge valve is incorporated at the end of the blast main. A small volume of air is passed forward through the blast main and out through the various purge valves during the gas making period and at the beginning of the blow phase. These purge valves automatically close as the blast valves open.

In the event of a blast valve seating incorrectly during the gas making period, gas leaks out into the valve and is immediately swept forward by the current of air passing through the purge valves. The trouble is immediately obvious to the operator as he can see the escaping gas. This system of operation had been used by Messrs. Tully's for a number of years and has proved highly successful. The alternative method is to maintain the pressure in the blast main higher than the gas pressure, during the gas-making period, but in this case, in the event of the valve seating incorrectly, air will leak into the generator and this leak can only be detected by calorific value determination, gas analysis, or increase in the gas-making figures. There is, therefore, a considerable risk of a delay before the trouble is located.

B.I.F. Industrial Gas Conference

THE second day of the Gas Council's B.I.F. Conference held at the Queen's Hotel, Birmingham, on April 28, was devoted entirely to business. Mr. H. F. H. Jones, M.B.E. (Deputy Chairman of the Gas Council) presided during the earlier part of the morning, but having imperative engagements elsewhere, vacated the chair in favour of Mr. H. R. Hems (West Midlands Gas Board and Chairman of the Industrial Gas Development Committee).

Mr. Jones pointed out the difference in the arrangements this year compared with those of a year ago, a change from one to two days. He was certain that the importance of the work of the industrial gas development side of the industry was going to increase, but was not sure that hitherto that had been sufficiently realised. If this country was going to prosper and develop and live at the high standard of living such as they all hoped to enjoy, industry had got to be productive. If they were going to get the increased productivity which the use of gas in industry could give, they had to show industrialists how to make the best use of gas, and to use it for more processes.

He hoped for continuance of the high standard of quality of the technical services that the gas industry could give to industry generally. Very many of them had spent the past few years explaining to people in industry that they could not have more gas because of restrictions and tremendous demands from industry for gas; and life had been frustrating and difficult for everybody. But now more and more boards were in a position to offer gas for sale and to go to the industrialist and ask what they could do for him. Where there was not enough gas to go round, he could only urge further patience and that they should do whatever could be done to enable available gas to be used with the utmost efficiency.

If there was to be a space heating load either in industry or in the homes, there must be a summer load to counterbalance if they were to sell space heating gas at anything like an economic price. He did not think it possible to build new plant and allow new distribution systems to work for just a few months of the year. It was necessary to look for an all-the-year round load so that the ratio of summer and winter demand remained at a reasonable figure.

The Gas Council had made an important formal recommendation which he thought would probably be accepted by the area boards that in future they should co-ordinate the marketing of gas and coke and not regard them as two entirely separate parts of their work. He urged all staffs of area boards to tie together the sales promotion and sales development of gas and coke in the spheres in which they could be used most efficiently.

Mr. H. R. Hems reviewed the work in 1952-53 of the Industrial Gas Development Committee.

Competition with other Fuels

Referring to competition with other fuels in industry and the thorny question of price, the Chairman said that if tariffs were rightly designed and the charges for gas rightly calculated, there was no question of industrial consumers being asked to pay high prices to subsidise domestic consumers, or, alternatively, for domestic consumers to pay higher prices so that industrial consumers might get gas cheaper. His personal view was that the large type consumer was complementary to other types.

Mr. L. F. Randall (S.E. Gas Board) hoped, with the new appointment of Mr. Hayman and other changes, they would be able to co-ordinate research within industry insofar as it affected industrial applications. He thought they had an excellent range of very efficient appliances, but were getting too much concerned with the price of gas instead of being concerned with thermal efficiency. He hoped in the coming year they would be able to direct their attention to the improvement of thermal efficiency in order to achieve a lowering in production costs. He thought the Gas Council should be able to appropriate a fairly liberal portion of their revenues to the furtherance of gas research.

The **Chairman** said one or two quite difficult problems were involved in that question, but the point would be conveyed to the appropriate quarters at the appropriate time.

Mr. H. R. Hems said they must bear in mind that the work being done at the moment was by the area boards. There was no lack of this work going on at Birmingham, at Watson House, and in the Leeds and other centres. The Committee only guided these activities.

Mr. Marlow (S.E. Gas Board) assumed Mr. Hems regarded the oil industry as the principal competitor. Oil had similar advantages to those offered by gas in the way of ease of control.

Mr. W. L. Howe (N.W. Gas Board), in appreciating the tremendous amount of work done by the few members of the Committee, suggested that consideration be given to the far wider use of the knowledge of many senior men. He suggested an extension to the classification scheme, the preparation of the projected 'Industrial Gas Engineers' Handbook,' and stressed the need for a text-book for the man entering that sphere of their industry.

Tariff Policy

Mr. J. H. Dyde (Deputy Chairman, Eastern Gas Board) asked whether they were putting industrial gas across. Were they training their industrial equipment service engineers in the best possible way? Had they got sufficient of them to meet increasing competition and the very real need there was to expand their industrial load? The team that went to the U.S.A. found a number of tariffs, but the position in regard to the latter was very much easier there and more flexible than in this country because there was abundant use of cheap natural gas. Tariffs, to be of any use at all, must essentially and basically be instruments of competition in sales promotion and, in order to study tariff structure, one must look into load characteristics.

He was disappointed in the relatively insignificant size of the Gas Section of the B.I.F. for an industry which represented sales of gas to the value of £27 mill. a year. The section had been reduced by virtue of the fact that they were getting so few participations from the manufacturers. Were they giving the encouragement they ought to the firms who were trying to develop sound industrial gas equipment? With reference to the question of coal carbonisation yielding a cheaper therm, they had just been cut a million tons in their allocation of coal for the next six months. If they were to expand their load on the industrial or domestic side in the next six months, they would have to make more gas from coke and from oil.

The **Chairman** welcomed the reference to the B.I.F. Many of them had watched the gradual decrease of the Gas Section. In a radio report of the B.I.F., there was no mention of the gas industry. They had reached a very low ebb and it looked as if the future of the gas industry, as far as the B.I.F. was concerned, was in jeopardy. They might have to reconsider the question, to see if they could get greater representation of the gas industry as an industry and not merely as one section of the B.I.F.

Mr. R. F. Hayman (N.T. Gas Board) said a lot of work had gone into the present classification scheme, but the time was approaching for review. Probably what was needed was not so much expansion or revision, but modification of specific sub-sections. He hoped the 'D' scheme was used as an authority and that reports were not filed and forgotten. It was hoped to resume work on the handbook shortly.

Mr. W. H. Herbert (S.W. Gas Board) said the industrialist was primarily concerned with the relation of his fuel cost to the finished work. Could they be sure that the results of effort on research were properly disseminated? The efficiency of their equipment was increasing. Was their efficiency of presentation to the industrialist increasing?

The Baking Industry

Mr. A. E. Livett (N.T. Gas Board) was principally concerned with the baking industry. Since the war, the North Thames Gas Board had built up a very attractive load of some 6 mill. therms, but was faced with competition from oil and that competition had been very largely stepped up by the action of other boards which very often had been unable to meet requests for tariffs for bakery loads. Consequently there had been a very great effort by the oil industry who could supply fuel much cheaper than gas could be supplied. Gas in some cases had an amenity value of 3d. a therm, but it seemed to him that in the next 12 months they might lose several million therms of their hard won baking loan, which would be most unfortunate.

The **Chairman** said the majority would probably agree that, for the moment, they could not see daylight. The problem of the imposition of special process rates could be considered only by the Commercial Policy Committee.

Mr. A. E. Wilson (N.E. Gas Board) said, although they did not produce oil to any large extent in this country, it could be regarded as an indigenous fuel. He urged that there should be a national effort to sell the use of gas in industry. He thought that more reports would be forthcoming if greater recognition could be afforded to authors.

Mr. R. F. Hayman said for 18 years the Committee had had as a policy that authorship of reports should be on a gas company or, later, board level. Individual mention might mean those best equipped to produce reports would have too high a proportion of credit.

Mr. W. F. Howell (N.W. Gas Board, Manchester Division) in discussing competition, said it all added up to the fact that in certain processes oil could be applied as efficiently as gas.

The **Chairman** then introduced **Mr. E. A. K. Patrick** (N.T. Gas Board) who, with Mr. J. F. Waight (W.M. Gas Board) presented a paper on 'Competition and the Technical Approach.'

Engineers as P.R.O.s

Mr. J. A. Stretton described the industrial gas engineers as public relations officers who got in contact with the industrialists or any person likely to buy a fair quantity of gas. He could not help feeling that the industrial gas engineer on the district was controlled quite a lot by board or national policy. They must do something to give promotional tariffs or special contracts; at least they should have competitive prices with which they could enter the market on level terms with oil.

Mr. Waight, replying, said, while there was a fair amount of equipment which was now gas-fired which could be converted quite readily to oil firing, the higher flame temperature of oil introduced special problems. He instanced cases in which his organisation had shown better results with gas than with oil firing. Generally speaking, if a manufacturer wanted oil-fired heat treatment plant he would have to invest in entirely new equipment.

Mr. T. H. Pardoe (S.W. Gas Board) expressed doubts on the advantages of recuperation on controlled atmosphere plants or intermittently used furnaces. A feature had been made of the high temperatures which one might expect, but he supposed 95% of their work was at temperatures of less than 1,200°C.

Mr. Waight, replying, said the design of a burner which would accept hot air at varying temperatures and maintain a constant air-gas ratio was one of the problems for the future. There was a strong case for the development of cheap recuperators which would use high air velocities; they had hoped they had put the work on new materials and high temperatures in its right perspective. Most of their progress must be made at the moment in the big loads operating at modest temperatures, but they must keep their eyes on the future. What was not important today might be so in 10 years time.

Mr. G. E. Thomas (Eastern Gas Board) said they wanted more evidence of manufacturers being realistic and progressive in translating scientific knowledge into practical appliances or their research was devoted to no purpose at all.

Mr. Waight, replying, said he agreed there was a possibility that manufacturers were not accepting their work as widely as they might. Nevertheless, there were manufacturers who did, and as a result they believed the appliances they made were improved.

Need for 'Exceptional' Recruits

Mr. W. A. Lloyd-Dodd (N.W. Gas Board) said the paper made clear the necessity for a high quality technical appreciation in the industrial departments of the gas boards and readiness to deal with new developments and to make sure that the advantages of such developments were put over to the industrial consumer. Much more attention should be paid to attracting exceptional recruits to the industrial side of the industry and considerably more provision should be made for the training of such personnel.

The **Chairman** said the whole matter was being taken up in a very lively way with the Commercial Policy Committee.

Mr. A. J. Skinner (S.E. Gas Board) said he did not think the right man got in touch with the industrialist. The man should be one who knew of the difficulties of development which arose day by day. They must always have a fresh, unorthodox approach to the job.

Mr. C. G. Broome (N.E. Gas Board) referred to the value of the industrial load at £27 mill. paid by 114,000 consumers and said surely a load of that kind called for special contract prices and tariffs?

Mr. Hayman said they were not always ready to publish results of research work prematurely, since it was necessary to ensure that the production of particular equipment was established before publication of information, to avoid misunderstandings on the part of the selling staff. There were delays in getting development ideas translated into practice, which, in some respects, the industry felt were too long. There were extenuating circumstances. He then quoted details of the refractories industry in which something like 2% of the output was insulating refractories, which, to industrial gas, was a most important part of their work. Delays were entirely due to force of circumstances and the manufacturers were particularly helpful to the limit of their capacity.

Mr. Mervyn Jones (Chairman, Wales Gas Board) paid tribute to the work of the Industrial Gas Development Committee and in particular the value to the gas industry of their publications. He instanced that value by citing his personal experience when recently meeting three Ministerial advisers. The most valuable document the Board was able to submit was the report of the Industrial Gas Development Committee on alternative fuels.

Two papers were read at the afternoon session, at which **Mr. H. R. Hems** presided. One was on 'Promoting the Best Use of Gas in Industry,' by **Mr. A. H. Bird,** M.B.E. (Eastern Gas Board), and the other on 'The Critical Point,' was by **Mr. W. L. Howe** (N.W. Gas Board). A joint discussion followed.

Mr. W. F. Howell referred to the suggested separate functions of industrial engineers. He said they had to bear in mind that the main thing they had to take an interest in might be summarised as increasing the gas load for industrial and commercial purposes and everything should be subordinated to that aim. The industrial man could always delegate the clerical responsibilities of his job without passing it entirely into other hands.

Mr. Howe, replying, said, often owing to lack of staff and facilities, industrial engineers had to measure up for fitting work and he submitted they all should be specialists in their jobs.

Mr. G. E. Thomas said they were up against the competitive angle, with their backs to the wall. They had had critical hours. They had a fuel technology service second to none. He considered that the industrial load was such today that it demanded a specialised course for gas engineers either alone or in conjunction with the Institute of Fuel. The industry would do well if they could establish testing centres throughout the country where industrial equipment could be fitted, tested, and, if necessary, condemned, and they wanted, at the same time, to encourage those appliance manufacturers with a far more progressive outlook. There were some manufacturers of industrial equipment who had not moved in 30 years.

Mr. A. H. Bird, replying, agreed with most of what Mr. G. E. Thomas had said. They must be very critical of themselves. It was time they set up some national standards of quality.

Mr. W. L. Howe, also replying, said the problem of test centres would be to limit the size of equipment they were to test. There would certainly have to be a limit because a lot of appliances and furnaces were ordered from the makers.

Mr. A. Higgs (N.E. Gas Board) said that with the multitude of appliances in some factories they might spend a month going through and making sure everything was functioning efficiently. That made a very big demand on staff time. He was interested in the way Mr. Howe stressed the point that everything virtually outside a domestic dwelling fell within the sphere of the industrial engineer.

Mr. Howe made it quite clear that he was concerned with establishing the principle that the commercial load should come within the purview of the industrial division. The smallest canteen enquiry might lead to a meeting with the managing director and improvement of the load.

Mr. Bird, replying, said that, with comparatively small resources in personnel, it was a question of suitable deployment of forces to cover an area in economy campaigns.

Mr. A. Bujnowski proposed a vote of thanks to all who had contributed to the success of the Conference, and **Mr. Howe** acknowledged on behalf of the authors.

BRITISH CHEMICAL PLANT

The British Chemical Plant Manufacturers' Association has published the 1953 edition of 'British Chemical Plant,' the Association's illustrated directory of members. This is now a biennial publication, the last edition having been published in April, 1951. The directory has three main sections: (1) A list of members with their addresses and, where they have wished to publish them, the names and addresses of their overseas agents; (2) an illustrated section consisting of members' advertisements; and (3) a classified index of products and services prefaced by advice to enquirers and followed by a key in French, German and Spanish.

As the central illustrated section is printed on white art paper and the other two sections on azure the reader is readily able to identify the three sections. The foreign language key is a new feature which materially adds to the usefulness of the publication.

A limited number of copies is available free of charge to chemical plant users who should apply, on their trade heading, to the Secretary of the Association, 14, Suffolk Street, London, S.W.1.

Gas Supply to Crawley New Town

Development Corporation Chairman Turns on the Tap

THE supply of gas from the Waddon (Croydon) works of the South Eastern Gas Board to Crawley New Town was formally inaugurated on May 14 when, in the presence of a large gathering of representatives of local authorities, engineers, and contractors, Sir Thomas Bennett, C.B.E., Chairman of the Crawley Development Corporation, opened a valve at Waddon to start gas on its 20-mile journey. In calling on Sir Thomas to perform the ceremony Mr. W. K. Hutchison, Chairman of the South Eastern Gas Board, said the gas would travel at 30 miles per hour through the new main.

Sir THOMAS BENNETT, in opening the valve, said: 'By opening this valve I have given life to many miles of main serving Surrey, Sussex, and the New Town of Crawley. May the gas which flows through it be a blessing to all those who use it in their homes and factories in this present generation and in many more to come.'

After the ceremony the guests were entertained to lunch at the Selsdon Park Hotel, where Mr. HUTCHISON proposed the toast of the Crawley Development Corporation. In doing so he said the creation of a new town meant not only the building of new houses and factories but also the provision of a whole range of services. This was where the gas industry came in. It was an old industry and was not always given credit for being up-to-date. For that reason they welcomed the opportunity of joining in this newest form of town planning and supplying to the townspeople the latest and most modern gas appliances.

The Board dealt with the new town both for gas and water. They were partners with the Corporation in the important Weir Wood water scheme which would ensure the water supplies needed for the future. In the meantime, they were pleased to have been able to help by supplying water to Crawley from their East Grinstead undertaking.

The building of the new town had to be planned far ahead and the gas industry had joined with the Corporation at all stages in seeing that gas service kept pace with the general development. The needs of the new town were first known in 1947 and the three gas companies which were then concerned, Croydon, East Surrey, and Horley, in consultation with the Ministry of Fuel and Power discussed a scheme for supplying gas to Crawley from the Waddon works. Nationalisation then took place and the Board had the task of providing the supply. The Waddon works was well sited for development and the Board had planned the main to Crawley so that it could also supply gas which would be needed in future in Redhill, Reigate, Dorking, and Horley. In that way the supply to Crawley was being fitted into the Board's plan for achieving more economical manufacture and distribution of gas over that part of the area.

The Minister of Fuel and Power had accepted the view expressed in the Ridley Report that there should be free consumer choice of fuel. This principle was accepted by the Crawley Development Corporation at an early stage and the Board was satisfied with the choice that both domestic and industrial consumers had made. Gas was used at Crawley for many industrial processes where easily controllable heat was required; for example, in the heat treatment of metals, the drying of moulds and cores, brazing, plating, and so on.

Sir THOMAS BENNETT, responding to the toast, paid tribute to the way in which the former Croydon, East Surrey, and Horley Gas Companies approached the problem of gas supply to the New Town, and said that when those companies were transferred to national control they detected no interruption in the preparatory work. To have laid 20 miles of main, starting at 20 in. and finishing at 18 in. diameter, in so short a period was a great achievement reflecting credit on all who had been in any way concerned. The only further step he could have desired was that the Board could have obviated the necessity for an ugly gasholder to serve the New Town. The consumers had been given freedom of choice; 80% of them had chosen gas for cooking and 33% had chosen gas for water heating, and a large number of firms had adopted gas for industrial purposes.

Mr. R. S. JOHNSON, Deputy Chairman of the South Eastern Gas Board, proposed the toast of the guests, among whom he mentioned Mr. R. H. M. Thompson, M.P. for Croydon West, Mr. K. Stock and Mr. J. S. Smith, of the Ministry of Fuel and Power—'our partners in a great enterprise,' Mr. Harold Wiliams, Deputy Chairman of the former Croydon Gas Company, and representatives of highway authorities, pipe manufacturers, and the contractors who actually laid the main.

Mr. R. H. M. THOMPSON, M.P., replying, said that although he was not a member of the political party that originated the nationalisation of the gas industry he felt that nationalisation had proved itself to be to the advantage of the industry, thanks very largely to the excellent teams of men who, having served the industry well under the old individual undertakings, were serving the nationalised industry with even greater devotion and enthusiasm.

Waddon Extensions

Gas required to meet the domestic and industrial needs of Crawley and the districts served by the former East Surrey and Horley Gas Companies will be about 10 mill. cu.ft. a day. The manufacturing plant at the Waddon works, is being enlarged to provide this. A carburetted water gas plant with a capacity of 3 mill. cu.ft. a day has been erected, and a new intermittent vertical installation, which will produce 3½ mill. cu.ft. of gas a day, is under construction.

No. 1 Section of the new main—Waddon to Hooley Lane—consists of approximately 12 miles of 24-in. main laid in 16-ft. length of pipe, and completed in approximately 20 months. It was necessary to make special arrangements with the British Transport Commission for laying the main under six railway bridges and to make agreements with three owners of land for the main to be laid through their property.

No 2 Section—Hooley Lane to Horley works—consists of approximately 4½ miles of 18-in. main. The laying of this part of the main was begun in September, 1949, and completed in July, 1950. Agreements were made with six owners of land for the main to be laid through their property and with the British Railway Commission for laying the main under two of its bridges. This section has been connected to No. 3 section and connections have been arranged in the holder field adjacent to Horley gasworks so that a supply can be taken from this main through a volumetric governor into a 1½ mill. cu.ft. holder, the erection of which has been commenced.

No. 3 Section—Horley works to Crawley holder station—consists of approximately 3.6 miles of 18-in. main laid in 18 ft. lengths, begun in April, 1951, and completed in October, 1951. This main has been connected to the ring main at a point close to the new Crawley holder station pending development of this site.

Ring Main

A 20-in. ring main in 18-ft. lengths is being laid from the point referred to in Section 3. The laying of this main will proceed in conjunction with the development of the New Town and will gradually reduce to 12-in. diameter on the southern side of the town. Approximately 2.6 miles of the main have been laid.

Gas is being delivered through the existing boosting system at Waddon works. The second stage will be to deliver gas by means of two steam-driven boosting plants to be installed at Waddon. The plants will have a capacity of 500,000 cu.ft. per hour with an initial working pressure of 5 lb. per sq. in.

To coincide with the installation of the pumping plant at Waddon works a 1½ mill. cu.ft. holder and three 500,000 cu.ft. per hour diesel boosters will be installed at Crawley holder station for the delivery of gas into the ring main.

For the final stage gas will be delivered into holders at Hooley Lane holder station, Redhill, from Waddon works.

An extension of the gasification site at Rock, near Bewdley, where tests are being carried out on underground gasification of coal and the piping off of the resultant gas, is proposed by the Ministry of Fuel and Power. A planning committee report to be considered by Kiderminster Rural Council recommends that no objection be raised to a proposal to increase the site by 2½ acres for three years. The larger area, it is stated, is needed for an electro-linking trial, and work to be done would be similar to that already carried out on the existing site. The County Planning Officer has informed the committee that because of their flora, fauna and minerals, four areas—Dowles Brook, Seckley Wood, Witnells End Quarry and Fenny Rough—have been scheduled as of special scientific interest under the National Parks and Access to the Countryside Act. The committee considers that Habberley Valley, on the Kidderminster boundary, should be added to the list.

Gas Staff Association Resolutions

Vigorous National Campaign Urged

THE 73 resolutions and amendments submitted to the annual conference of the British Gas Staff Association at Brighton on May 8 and 9 covered a wide range of subjects. Some were withdrawn, others were referred to the National Council, and a number were defeated when put to the vote. One of the chief resolutions passed was one submitted by the Wandsworth branch urging the necessity for a vigorous national campaign for the recruiting of new members in pursuit of a clear majority on negotiating bodies. Another, of domestic importance to the Association, carried overwhelmingly, was in support of the National Council's desire to provide a pension scheme for the Association's full time officers and staff.

Under the heading of terms and conditions of service, one resolution expressed alarm at the rapidly decreasing differential between staff and intermediate grade salaries and manual workers' wages, and asked the National Council to endeavour to maintain as large a differential as possible. Another pressed for the 'rate for the job' principle to be applied in cases where employees are required to undertake more responsible duties than those covered by their grading.

The conference deplored the 'apparent downgrading of positions' by some area boards when vacancies occur, and instructed the National Council to make representations accordingly. Accepting that the implementation of national salary scales in some areas has not been co-ordinated with that in other areas, resulting in various grades being applied for similar duties, the conference, on a resolution submitted by the Kirkcaldy branch, asked for investigation and action at the appropriate time to achieve a better degree of uniformity of grading on a par with the highest grading now accorded.

The conference carried a resolution from the Leamington Spa branch 'that equal pay for equal work be pressed still further on behalf of female workers in the industry,' and from the Portsmouth branch there was a resolution advocating the closing of all offices and showrooms on Saturday afternoons.

Mr. W. E. Webb, J.P., re-elected Chairman, with Mr. F. C. Henfrey-Smith, the General Secretary.

The conference considered that the staff consultative committees should be developed and encouraged by the management with a view to full and frank consultation with the staff representatives on matters of policy and general efficiency as well as safety, health, and welfare.

Under the heading of organisation and policy the conference endorsed a proposal from the West Yorkshire Grid branch that another full time organiser should be appointed immediately, to be followed by a further appointment as soon as finances permit.

Resolutions concerning national policy were carried by the conference asking the National Council to endeavour to obtain immediate removal of restrictions on promotional advertising by the gas industry; urging more resolute steps towards employee representation on area boards; and asking the Chancellor of the Exchequer to take steps to alleviate the increasing hardships to gas consumers, appliance manufacturers, and the gas industry caused by hire purchase restrictions and the high rate of purchase tax on some essential gas appliances.

Recalling last winter's fogs, the conference asked for a Government fuel policy, particularly with regard to new towns, which ensures the greater use of smokeless fuel. Finally it reiterated its concern at the growing dependence of the gas industry on the National Coal Board for gas from coke ovens, and urged that the ownership of coke ovens should be transferred to the gas industry.

Mr. W. E. Webb, J.P., was re-elected Chairman; Mr. C. C. Holt, Vice-Chairman; and Mr. H. L. Bristow and Mr. F. Lovell, Auditors.

The annual report recorded a total membership of 17,489, a net increase of 163, and the opening of four new branches, and reviewed in detail the year's progress in organisation and the work of the National Joint Council for Gas Staffs, on which the Association continued to occupy seven seats. Redundancy questions arose in the areas of the South Western and Southern Gas Boards. As a result of steps taken the number of staff employees of the South Western Board who left the Board's service was reduced from 101 to about 50, most of whom were superannuated. In the Central Division of the Southern area alternative employment was found for nearly all the B.G.S.A. members affected by redundancy, and in the Northern Division redundancy at two undertakings was discussed with officials.

The Chairman, Mr. W. E. Webb, receiving Mr. W. K. Hutchison, Chairman of the South Eastern Gas Board, and Mrs. Hutchison at the B.G.S.A. banquet.

The First Issue of a new quarterly publication, *Scientific Film Review*, has appeared. It consists of critical appraisals of new films dealing with industry, agriculture, medicine, and scientific subjects, prepared by the appraisal panels of the Scientific Film Association and published as a supplement to the monthly *Film Bulletin* of the British Film Institute. The first issue contains details of 17 new films, ranging from purely scientific instructional films on electricity to films on engineering, textiles and medicine. A specimen copy can be obtained from the General Secretary, Scientific Film Association, 164, Shaftesbury Avenue, W.C.2.

Bakers Worried.—Members of the North Western Federation of Master Bakers' Associations to which some 20 associations are affiliated are being advised to cease installing gas ovens and to convert to other fuel where practicable because they are getting worried about the recent increases in the price of gas. Mr. Frank Jennings, President of the Liverpool Master Bakers' and Confectioners' Association, says the position is that any people in the industry and especially the smaller bakers are seriously considering going off gas for baking. Anyone who was thinking of installing new ovens would be inclined not to have gas ovens owing to the price of gas. Other members of the industry agree that the price is getting beyond them, and that they are losing their enthusiasm for gas.

THE COOLING OF GASES AND VAPOURS

By RALPH POLLARD, Assoc.M.Inst.Gas E.,

Research and Development Engineer, R. & J. Dempster, Ltd., Manchester.

From a paper to the Manchester and District Junior Association of Gas Engineers

THE object of the work described in this paper is to prove the soundness of the design method for cooling permanent gases in the presence of water vapour or, conversely, condensing vapour containing permanent gases, as suggested by Colburn and Hougen. The paper is not intended as an academic thesis and emphasis is laid on a simple practical approach with due regard to actual gasworks conditions.

Colburn and Hougen published their paper in 1934 and in view of the enormous amount of fundamental research, (Ref. 2, 3, 4)* preceding it and its obvious application to the design of gas coolers it is surprising that the use of the data has not been referred to in the gas industry in the subsequent 20 years or so.

Hollings and Hutchinson, (Ref. 5) Francombe and Grant, (Ref. 6) and Redman, (Ref. 7) refer to the method but Redman alone, in 1951, published details of its application to gasworks practice.

While it is not considered necessary to record here the full details of the basic principles involved, certain aspects may warrant inclusion for reasons of completeness and the author craves the indulgence of those readers in full knowledge of the argument.

Design Considerations

It was decided to investigate the performance of two designs of gas cooler, both having vertical water tubes but one allowing gas to pass parallel to the tubes in a number of passes and the other across the tubes. The former is the well-known design, in common use today, which largely superseded the classic horizontal tube condenser. Properly designed it can be an efficient unit but there are limitations in its use when consideration is given to water velocities.

It is generally recognised that, at certain velocities, thermo-syphoning or inversion of temperature can take place in a pass and affect the efficiency of the unit. The number of tubes in the pass having been fixed for reasons of gas velocity it is questionable whether it is permissible to sub-divide the pass on the water side to increase water velocity since concurrent flow of gas and water must then take place. It is possible to alter the sizes of the passes throughout the length of a cooler and to rearrange the alternate passes where the cooling water passes downwards, even to the extent of using tubes of different diameter, but a number of stagewise calculations are needed to balance all conditions and the design is not straightforward.

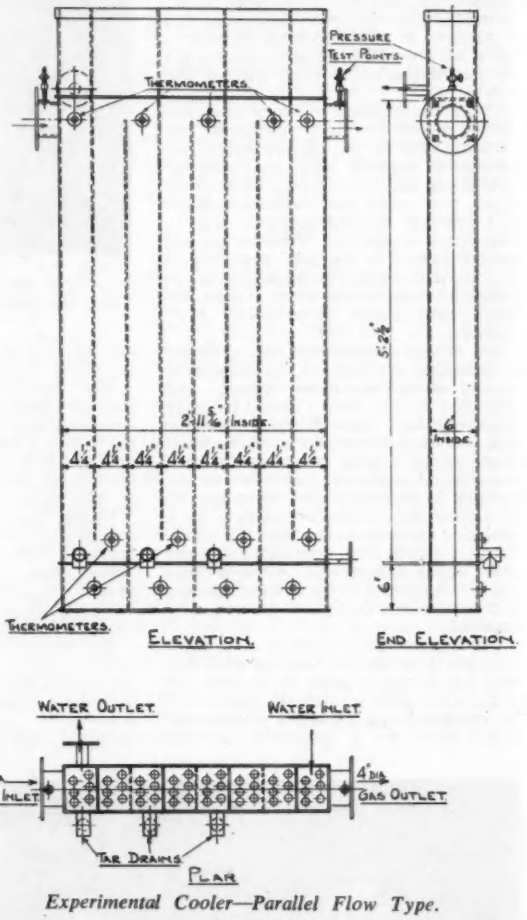
A cooler having vertical water tubes with gas flowing across the tubes allows considerable flexibility on the water side and only the limitations as to accessibility for retubing restrict the size of the water passes. Further, when using recirculated water in an arrangement incorporating a water cooling tower it is an obvious move to use the make-up water on some portion of the cooler at the gas outlet end to reduce the temperature of the gas below that which would result from the complete use of the tower water. Since the make-up water would be about 10% of the circulated, then, for equal velocities, the water passes on make-up would have to be sub-divided to give one-tenth the number of tubes in the main passes.

The cross-flow type cooler is admirably suited to this arrangement and, of at least equal importance, the subdivision can be made for exactly the surface area required.

As a matter of interest a graph was prepared showing the effect of increasing water velocity from a value at which thermo-syphoning is definitely occurring in the downward water passes. A smooth curve prevails at a velocity of 0.15 ft. per sec.

The frictional pressure loss for flow across staggered rows of tubes is considerably higher than that for parallel flow, but it is possible to make comparable designs if due attention is paid to other causes of pressure loss.

Although the frictional loss may be negligible in the orthodox design, the ruling effect occurs at the cross-over



Experimental Cooler—Parallel Flow Type.

openings in the division plates where change of direction occurs. The change of direction losses are calculated on the maximum velocity at that position, the size of the opening, pitch of tubes on each side and distance from division plate to the first row of tubes all having effect. The change of direction loss for the inlet branch at the hot end may be considerable and enlargement and contraction losses contribute in no small part to the total pressure loss.

On the other hand, while the frictional loss is higher for the cross-tube type, the change of direction losses, etc., are of a much lower order than for the parallel-flow type and it can be shown that advantage may be taken of the greater heat transfer coefficients for the cross-tube type while maintaining equal or better pressure drop values than those obtaining for the orthodox type.

* See Bibliography, *p.438.*

As mentioned earlier, it was decided to test two types of cooler, a cross-flow and a parallel-flow design. Both units were designed for 3,000 cu.ft. of cool gas per hour, to be cooled from 165°F. (sat.) down to 60°F.

Experimental Plant

The cross-tube cooler was made in one unit of mild steel and exactly as a full scale unit. There were 240 $1\frac{1}{16}$ in. outside diameter tubes $11\frac{1}{2}$ in. long between tube plates, and the gas was made to flow across the vertical tubes through four passes. To maintain a reasonable water velocity the tubes were arranged in nests of six, thereby forming 40 passes on the water side. One departure from full-scale practice was made in that no means were provided to bring the gas to the unit through specially-designed distribution manifolds as it was felt that the ratio of inlet main to tube length (4 in. to $11\frac{1}{2}$ in.) would ensure reasonable spread of the gas on entry.

Means were provided for the measurement of gas at three levels on the gas side and for a reading in every water pass at the top or, in other words, at approximately 2 ft. intervals throughout the length of the cooler.

The parallel-flow cooler was made in two eight-pass (gas) units, each containing 48 $1\frac{1}{16}$ in. outside diameter tubes 5 ft. $2\frac{1}{2}$ in. between tube plates, in nests of six. The gas and water were in countercurrent flow.

The cross-flow cooler was installed first and erected adjacent to the foul main as it left the collecting main of a 50 in. experimental retort. After passing through the cooler the gas was treated in a Livesey washer before feeding back through an orifice plate to the foul main. After making a series of runs, the unit was replaced by the parallel flow cooler and further tests were made.

Details of both units are shown in the accompanying sketches.

Test Result

Cross Tube Flow Cooler (Lagged)

Run No. 7c Free area = 0.1388 sq. ft.
Velocity = 8 ft. per sec. (S.T.P.)

Gas rate (cu. ft. per hr. at S.T.P.) = 4,000
Cooling range = 160°F. to 53°F.
Saturation temperature = 156.5°F.
Water rate (gal. per hour.) = 200
Water temperatures = 44.5°F. to 91.5°F.
Heat Balance:
Heat from gas = 4000[(25−1.5) + (0.1008)]
= 95,803 B.Th.U.
Heat to water = 200×10×47 = 94,000 B.Th.U.

The heat balances to within 2% and is therefore considered satisfactory.

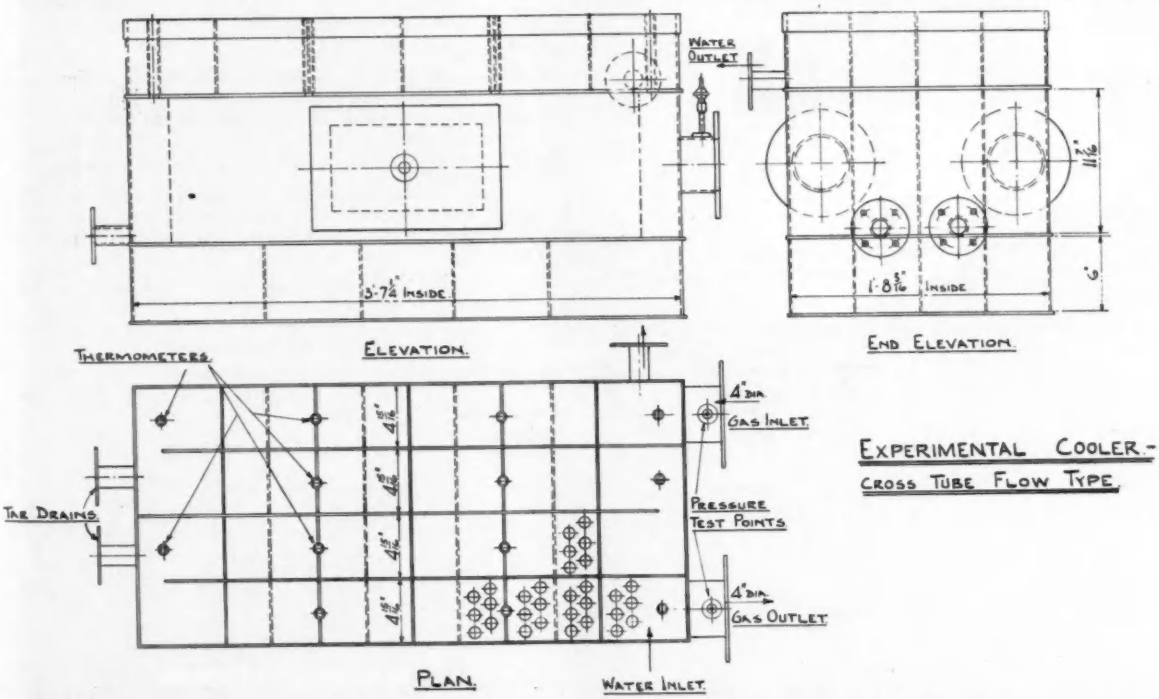
Gas Analysis.

CO_2	= 8.6%	CH_4	= 10.9%
C_4H_8	= 1.3%	H_2	= 51%
O_2	= 0.5%	N_2	= 4.2%
CO	= 23.5%	Mol. wt.	= 15.196

Summarising,

Area for saturated gas	= 61.4 sq. ft.
Area for condensate cooling	= .4
Area for range 160°×156.5° (actual)	= 1.6
	63.4 sq. ft.
Actual area of cooler	= 63.95 sq. ft.

The use of the design method for cooler condensers outlined by Colburn and Hougen predicts a surface area requirement extremely close to the actual area of the experimental cooler. It is pointed out that this statement refers only to cross-tube flow and it would be of value to compare the method given by Bureau, using the $\frac{\text{B.Th.U.}}{K}$ values given in the paper by Redman.



EXPERIMENTAL COOLER - CROSS TUBE FLOW TYPE

Over the period of the work the gas varied in composition, although for each test normally constant conditions would prevail. It was necessary, therefore, to make a gas analysis and saturation test for each series of runs.

The analysis was made in the usual manner and the apparatus described by Craddock (Ref. 9) was used for the estimation of the dew-point of the gas. Full details of the apparatus and method are given in the literature and the apparatus used for the test given in this paper was almost identical.

The heat transfer coefficients (overall) used by Bureau apply to cross-tube flow, although the water tubes are horizontal and not vertical as in the experimental cooler and the thickness of the condensate film will probably not be the same.

The surface requirement = 0.02808 × 4000 = 112.32 sq.ft.

The coefficients in Bureau's method are for 4.1 ft. per sec. at S.T.P. and the S.T.P. velocity in the experimental cooler is 8 ft. per sec.

$$\text{Vel. correction} = \left(\frac{4.1}{8.0}\right)0.75 = 0.605$$

and 0.605 × 112.32 = 68 sq. ft. Saturated gas

1 sq. ft. Range 160°—156.5

Required surface = 69 sq. ft.

No addition has been made to cover fouling, scaling, etc., as it is assumed that the condenser used to obtain the overall coefficients was fouled, at least to the same extent as the experimental cooler in Test 7c.

It should be noted that no consideration is taken of water velocity in Bureau's method and it is, therefore, to some extent fortuitous that fairly close agreement is found between Colburn and Hougen for cross-tube flow.

The following table shows the comparison between the overall transmission coefficients in the Test 7c found by the method of Colburn and Hougen and those of Bureau for 4.1 ft. per sec. corrected to 8 ft. per sec. using the exponent 0.75.

Comparison of Coefficients (Cross-tube Flow)

T°F Gas	Bureau K	Colburn and Hougen U
156.5	71.40	64.30
150	61.10	60.00
140	49.50	52.20
130	41.00	45.70
120	35.00	39.10
110	29.70	33.80
100	24.80	28.60
90	21.45	24.70
80	18.50	21.50
70	15.70	18.70
60	13.05	17.00
53	—	15.25

The parallel flow cooler was installed as explained earlier in the paper and particulars of one unit are shown on the accompanying sketch.

For the test described herewith only one unit was used, there being enough surface area to deal with the quantity of gas available at a somewhat lower saturation temperature than was expected for the two units in series.

Parallel Flow Cooler (Lagged)
Test No. P.4

Gas rate = 3,510 cu. ft. per hour.
Cooling range = 150°F. to 60°F. (gas saturated at 150°F.)
Water temperatures = 48°F. to 75°F.
Water rate = 240 gal. per hour.
S.T.P. velocity = 6.96 ft. per sec.
Free area = 0.14 sq. ft.
Equivalent diameter = 0.166 ft.

Gas Analysis

CO_2	= 3.7%	H_2	= 38.3%
O_2	= 0.6%	CH_4	= 19.9%
C_nH_m	= 2.0%	N_2	= 22.0%
CO	= 13.5%	Mol. wt.	= 16.831

Surface area = 91.75 sq. ft.
say = 92.2 sq. ft. allowing for condensate cooling
Actual area in cooler = 69.5 sq. ft.

There is not the close agreement between the calculated and actual surfaces in this test as that found for Test No. 7c.

It was pointed out by Colburn and Hougen (Ref. 3) that entrance effects for an experimental parallel-flow cooler increased the turbulence of the gas stream and enhanced the value of the mass transfer coefficients quite considerably. The values of the effects for that cooler would not be applicable to the apparatus used by the author and it was not possible to evaluate these quantities in the present case owing to a lack of controlling data.

Colburn and Hougen (Ref. 3) also put forward the theory that greater mass transfer coefficient result from upward flow than from downward.

It was decided to compare the actual surface used in the cooler with the theoretical, by dividing the cooler into equal parts and it was found convenient to consider the effect in each pass, there being 8.69 sq.ft. of cooling surface in each pass.

Cooling Range	Surface Required	
	Actual	Theoretical
150°-142°	8.69	8.00
142°-127°	8.69	13.13
127°-112°	8.69	13.00
112°-97°	8.69	9.90
97°-84°	8.69	11.92
84°-73°	8.69	12.95
73°-64°	8.69	14.85
64°-60°	8.69	8.45
TOTAL (sq. ft.)	69.52	92.20

These results do not offer evidence of any consistent entrance effect or improvement in the upward flow passes and considerably more work of a more exacting nature would be necessary to explain the better performance of the actual cooler.

In this example, the improvement in heat transfer overall would appear to be about 33%.

Parallel Flow.

The area required by Bureau's method (neglecting the 20% for fouling) = 62 sq.ft. or about 11% low.
The area required by Colburn and Hougen's method = 92.2 sq.ft.
Actual area required (Test P4) = 69.5 sq.ft.

N.B. It is assumed (as in the previous example) that the K values in Bureau's method were obtained on a full-size cooler, fouled to the same extent as the experimental cooler.

The following table shows the comparison between the overall heat transmission coefficients from the Colburn and Hougen method and those of Bureau for 4.1 ft. per sec. corrected for parallel flow and velocity.

A further column shows the Colburn and Hougen values corrected for the apparent increase in values in the experimental cooler.

Comparison of Coefficients (Parallel Flow).

Gas T°F	Colburn and Hougen		Bureau K
	U Calc.	U Found	
150	30.4	40.5	43.9
140	22.9	30.4	35.5
130	18.5	24.6	29.4
120	15.0	20.0	24.9
110	12.6	16.8	21.4
100	10.6	14.1	17.8
90	9.4	12.5	15.4
80	8.0	10.6	13.0
70	7.0	9.8	11.1
60	6.4	8.5	9.5

Although the foregoing material is by no means complete, there is evidence that Colburn and Hougen's method is sound in principle. The agreement between the actual and calculated area for the cross-flow cooler is most satisfactory and accurate forecasts may be made using the data and method.

It would appear that the application of the method to parallel-flow coolers leads to unduly high surface areas,

(*Continued on p. 438*)

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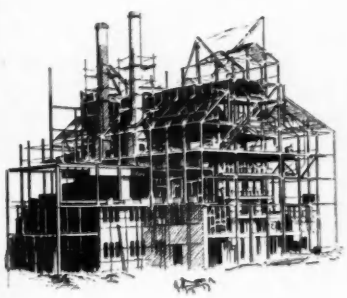

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Intermittent Vertical Chambers

By R. W. CROWTHER, M.I.Mech.E., M.Inst.Gas E.,
Director, W. J. Jenkins & Co., Ltd.

From a paper to the Wales and Monmouthshire Section of the Institution of Gas Engineers

AS a designer in the field of carbonising plant, I should like to say, particularly to the younger gas engineers, that you will never find a more varied or a more interesting subject. If you contemplate venturing into such a field, you will need, firstly, a cast iron constitution, and, secondly, an infinite degree of patience, not only in your dealings with the user of your designs—for he will always tell you where you are wrong, and it is essential that he should—but in awaiting the results of any projected improvement or development, which, to be of reasonable certainty can be upwards of five years, and even 10 years in certain cases. It is different from many purely mechanical engineering designs; those either work immediately and do the job intended, or they don't, and you can usually put a finger immediately on the cause of the 'don't.' Where engineering materials are subjected to stress, fatigue, and heat, particularly heat, the problems can be extremely complex. I feel that a word of commendation is called for to our research bodies, which have done a great deal during the last 25 years in giving us a better knowledge of the properties and behaviour of the materials we must use.

It is only by the closest co-operation between those who design and those who use plant that progress can be made, and such co-operation I have found in a very marked degree in the gas industry. This applies not only to the chief engineer, but to those whose work is concerned in the day-to-day manual tasks of running a carbonising plant.

THE PAST

Intermittent Vertical Retorts

The intermittent vertical chamber oven is a development of Continental practice. As far as I can ascertain, this system of coal carbonisation was originally developed from the Dessau vertical retorts in 1907 by the firm of Didier, and almost simultaneously by the firm of August Klonne, Dortmund (*Gas und Wasserfach*, November-December, 1952). The Dessau and other forms of intermittent vertical retorts had during the period from 1908-18 a popularity in this country as a natural sequence to the horizontal retorts, the reason no doubt being the idea of 'letting gravity do the work.'

The intermittent vertical retort settings were usually arranged in two rows of retorts, the retorts having capacities of 10 cwt. of coal. A typical large plant of this type was installed at the Ayres Quay works of the Sunderland Gas Company, in 1909-10, and was fully described in a paper by Mr. Chas. Dru-Drury to the North of England Gas Managers' Association. For the student, or indeed, others, who may be interested in the evolutionary aspect of plant design, that paper makes an interesting study, in that it indicated lines of possible development:—

(1) Combining the retorts into chambers.
(2) Eliminating the high pressures developed in the lower parts of the retorts (up to 6.5 in. w.g.).

In this country, however, development was neglected by reason of (a) the advent of the continuous vertical retort, offering, as it did, the discharge of cooled coke and a 'closed' system; and (b) the availability at that time of plentiful quantities of 'selected' coking coals.

Intermittent Vertical Chambers

On the Continent, however, such coal supply advantages were not enjoyed, and as a result the change-over from retorts to chambers was an obvious and quick development. So much so, that this type of carbonising plant was, and indeed is today, the principal form of coal carbonisation in gasworks. The development in constructional detail and improved efficiency has, therefore, been very marked.

It would seem that we in this country are now following closely the Continental practice in coal carbonisation, brought about by sheer force of economic circumstances; and unless there can be a great improvement in coal selectivity, in quality, quantity, and sizing, this form of plant will, with further improvement in general design and operating technique, become increasingly used, particularly for the larger units of plant.

Three main systems of intermittent vertical chamber practice emerged from the Continental developments, all of which are now available in this country, and differ from the other only in constructional detail. The principles are precisely the same.

Chamber Benches

Chamber benches were constructed in various units from settings of two and three chambers of 18 to 25 cwt. holding capacity, to settings of up to 10 chambers ranging from two tons to over seven tons capacity. Settings of the smaller number and size of chambers were invariably heated by built-in step or step-bar grate producers, the optimum limit being settings of six to seven chambers of three to four tons capacity, as beyond this the single internal producer became too big to be efficiently manageable. Beyond this, the practice was, and still is, to heat by external static or mechanically operated producers, usually the latter, and supplying cold washed gas to the settings.

Sizes or capacities of chambers on the Continent have tended to vary very considerably. The tendency in this country, more particularly since the war, and due to the shortage of design staff, has been to standardise on a range of about three sizes of chamber, which, in general, meet the usual requirements of the industry. It is likely, however, in order to effect reduction in capital cost, that sizes will be increased.

The practice of steaming for water gas production in retorts is generally attributed to Dr. Otto, who put forward the principle in about 1882, and many and varied have been the methods employed in applying this principle—as applied to chamber ovens, from using one or two chambers in a bench as a virtually separate water gas unit, to a sequence of steaming intermittently one or two chambers to give continuous or even rate of water gas output. Chambers have usually been steamed 'upwardly,' but in the system with which I am most familiar 'downward' steaming has been practised, the equivalent of the 'back run' process in common use with separate water gas plant.

THE PRESENT

For the successful and economical operation of intermittent vertical chamber plants, the following are the two principal factors of design:—

(1) *Chamber Discharge Door.*—This may perhaps appear to be putting the cart before the horse, but it will be appreciated that however good the design of the chamber construction it will fail if its support is inadequate. In the Jenkins design, the coke discharge door is a single unit combination of discharge door and support for the oven brickwork. This design is of all -welded steel construction, and embodies a water seal. This door is constructed in one complete and withdrawable unit. The whole of the door, and the support for the chamber

above it, is integral so that the support for each chamber is entirely independent of its neighbouring chamber.

The strength and durability of the support for the oven brickwork is of major importance in so far as it affects the stability and life of the brickwork above it. The criterion of deterioration of chamber brickwork is not attributed to the supports entirely, but one can appreciate the importance of adequacy in the chamber supports. The chamber supports should not become overheated.

In most types of plant use is made of the door or oven supports for the introduction of steam into the chamber. Steam can be admitted in two ways: (1) Through the intake steam pipes incorporated into the door frame; (2) alternatively, via the bottom gas offtake pipe. This double provision for steaming the chamber is to counter the possibility of a complete blockage of the steam nozzles into the oven, and to ensure at all times the continuity of steaming.

The 'dual' purpose chamber door/support and gas offtake is a development to reduce the gas pressure inside the chamber, particularly when carbonising swelling coals. Much ingenuity has been displayed in overcoming this disadvantage. One method is to embody a gas offtake formed in the door domes, which domes carry the coke breeze pad charged into the oven before the coal. So effective has been this design in eliminating pressure in the lower part of the oven that a water seal is now possible. The seal itself is about 2½ in. deep, but the limit of pressure in the chamber is less than 1 in. W.G. Above this, water will be forced over the seal.

(2) *Chamber Construction.*—It is the usual practice in chamber design to include what has become commonly known as the 'continuous bonder' method of forming the division between the successive horizontal heating flues, in the height of the chamber. Hitherto the heating flue divisions were formed by tiles resting on ledge blocks forming part of the oven side walls. This form of construction proved insufficient in strength to withstand the constant movement of the walls, particularly when dealing in this country with coals having a high swelling pressure index. This factor has an important influence on the maximum major axis width of the chamber, and in my opinion the major axis width is one of the principal limiting factors affecting the design and life of the chamber. The chamber wall can, in design, be considered as a table supported by a series of beams.

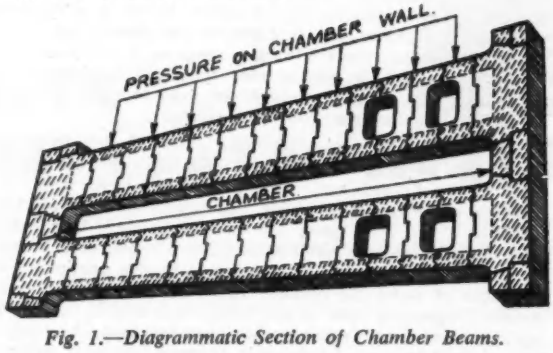

Fig. 1.—Diagrammatic Section of Chamber Beams.

If this hypothesis of design is accepted, then, firstly, the end supports for each beam must be firm and, secondly, the beam should, within the limits of the material useable, withstand tensile, compressive, and shear stresses. The first condition is met by: (a) Ensuring in the design of the setting that the expansion space for the silica material on the outer side wall of the setting is neat—in other words, the supports must take a proportion of the initial expansion thrust, and thus bind tight the ends of the beams; and (b) longitudinally, the thrust carried forward from chamber end to chamber end, and to the division walls between settings of chambers, must be met in full. This is accomplished by providing the correct expansion allowance in the periphery only of the setting, and a practical knowledge of the behaviour of the refractory material is of importance. The second condition would emphasise the desirability of using a refractory material with the same behaviour characteristics as steel. Nature has provided us with a material (silica) capable of withstanding to a large degree heat, conductivity, compressive and shear strength, but which is limited in tensile characteristics. The material suffers a gradual deterioration by being subjected to continued internal and facial stress by the alternate heating and cooling taking place.

Were it practicable to cast the beams *in situ*, pre-cast them, or, indeed, treat them in similar manner to reinforced concrete, then a forward step would be made in durability of the chamber. In my view the strength of the construction is the major factor affecting its life. To meet the case, the patented design of beam shown in Fig. 1 was evolved. The holes shown at the right hand end of Fig. 1 allow the heating gas passage from one flue to the next. My friend, Dipl. Ing. K. Hartmann (Klonne, Dortmund), made an attempt theoretically to treat this hypothesis from first principles of statics, and his conclusions have been published (*vide* 'References').

THE FUTURE

It is always dangerous to attempt to prophesy the future. I will content myself by outlining what in my view are the likely lines of future development in intermittent vertical chamber oven designing practice. Much will depend on the relationship between prices for coal and coke, and, of course, much needs still to be done by way of storage and preparation of coke for the market.

(1) *Smoke and Dust Emission.*—This is a feature of intermittent vertical chambers which has to be overcome where local amenities are affected. To some extent by vacuum extraction methods an amelioration of the position has been effected, but we need to go further. The principle of charging the ovens in a 'closed' system is the answer, but its fulfilment not so obvious. I feel, however, that the problem is not insurmountable. Progress may be made in this direction.

(2) *Steam Emission from Coke Quenching.*—There is no difficulty in overcoming this, where, again, local amenities are affected. Dry quenching of the discharged coke is a proved technique. Some few years ago the practice was considered uneconomical on account of capital and maintenance costs, but now, with the improved prices obtainable for coke, dry cooling plant is, I understand, being commissioned.

(3) *Waste Heat Recovery.*—There is a growing tendency to divorce steam raising from the carbonisation process as being an essential factor to obtain the highest thermal efficiency. There is no doubt that so far as intermittent vertical chamber ovens are concerned, the highest thermal efficiency is obtainable with the combination of internal producer, recuperator, and/or waste heat boiler. The whole process from coal into works to gas and coke out of the works, and the power and heat requirements for the varied processes within the works, must be carefully considered and balanced cost against cost for the various processes.

There may be justification in certain circumstances, in considering means other than waste heat boilers, to give optimum thermal efficiency/cost per therm. Fields for possible future consideration in I.V.C.O. plant design may be:—

(1) The use of metallic recuperators. This field is more promising than pre-1939, in view of recent developments in heat resisting steels.

(2) Regeneration (reversible), as is common practice in the coking industry, instead of recuperation.

(4) *Producers.*—There are at present available many designs of highly efficient external producers suitable for the generation of heating gas for chamber settings. Such producers can be arranged to provide either cold washed gas, or hot gas, according to circumstances. The fact remains, however, that for the highest thermal efficiency of the complete system the producer built integrally with the setting has the advantage. It is on this basis, and in consideration of the increased capital cost of external mechanical producers, that I believe that if the advantages of the external mechanical or self-clinkering producers can be applied successfully to the built-in producer, a step forward will have been made. Such producers are now being used successfully on the Continent, and a prototype will be installed in this country during this

(*Continued on p. 437.*)

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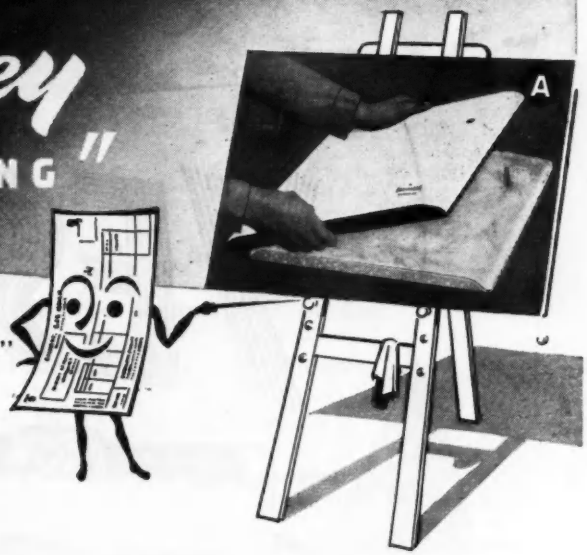

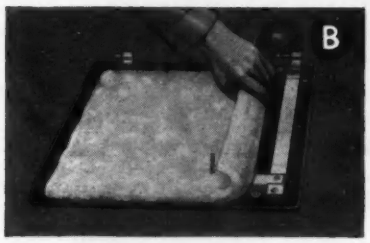

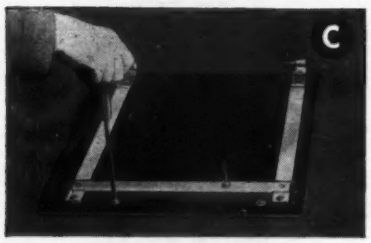

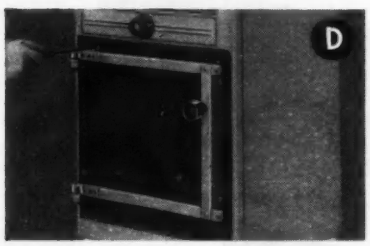

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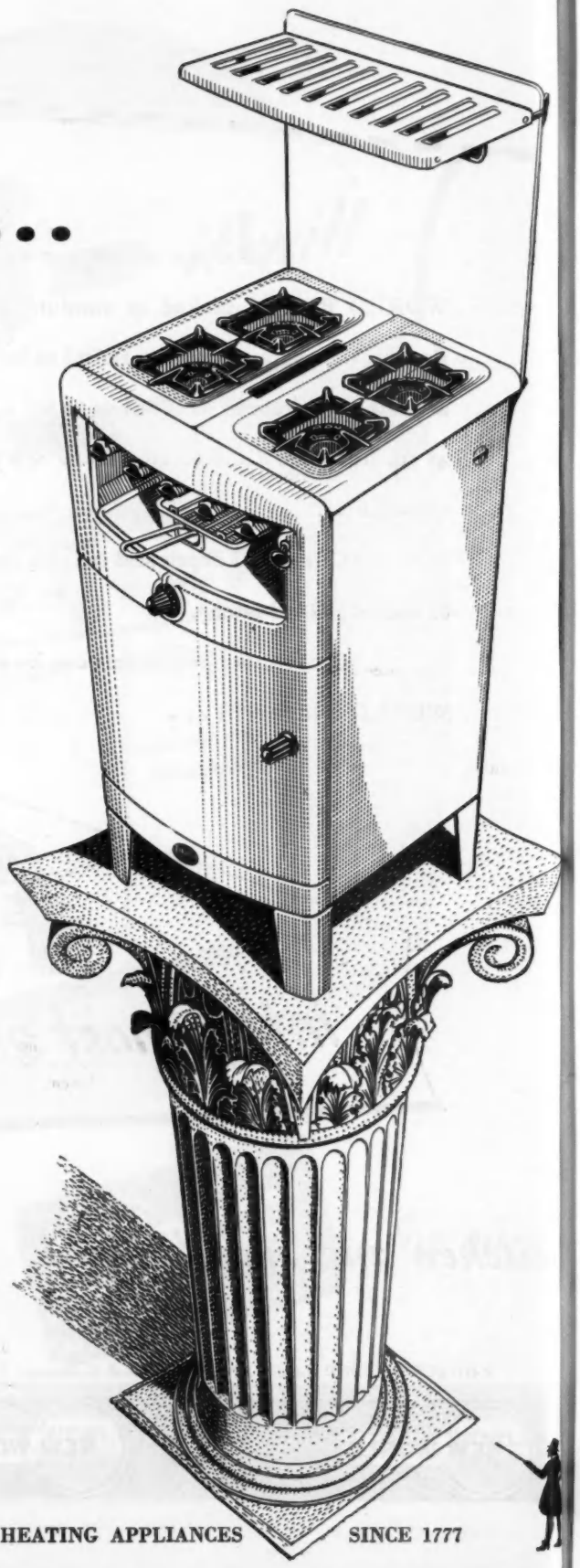

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summer by the North Eastern Gas Board. It will have the advantage of keeping down capital cost of plant, provide better labour conditions, reduce the combustible matter in the ash discharge, and make for less disturbance to the heating system.

(5) *Housing of Plant.*—This question is largely dependent on location of works, and where circumstances are such as to warrant the additional expenditure on an embellished housing for the bench, such can be provided in modern architectural style; many recent installations have been so designed.

Where circumstances allow, a development of the intermittent vertical chamber on similar lines to coke oven practice—that is, without housing, may be possible. This would materially reduce the capital cost of plant and may be a future necessity.

Alternative gas firing of intermittent vertical chambers has been successfully applied on the Continent. This practice has possibilities other than that of meeting a widely fluctuating output, particularly where for certain periods of the year a plant must be kept working on low output. In an article published in *Gas und Wasserfach*, November-December, 1952, Herr Gerhard Lorenzen, Hamburg, covers this point and that of flexibility. The following is a near translation:—

'Variation in make with constant coal throughout is brought about further by alternative heating by producer gas or coal gas. Heating by coal gas, which is the principal sale commodity of gasworks, has been adopted from coke oven practice. Seibel arrived at the conclusion that the higher cost of an installation for combination heating, due to increased complication in plant and operation, would easily be paid for. The complete change-over of an installation from producer gas to coal gas heating reduces the gas output (for sale) by about 30%, giving considerable plant flexibility, by change-over of separate settings or the whole bench. Without combination heating, the operating or charging schedule time must be changed. On gasworks with considerably varying loads, it is far more convenient to regulate make by combination heating. With a very good coke market, coal gas heating has of late been chosen as a permanent method. In general, one can say that coal gas heating, or coal gas enriched heating, with built-in producers, is advantageous for all installations not working under full load. Gas production costs of a producer gas heated installation climb at an increasing rate with under-loading. Production costs by introduction of a proportion of coal gas heating are lower than those with producer gas heating only, so long as the installation is under-loaded.

'In intermittent vertical chambers with external heating, the system adopted has been that of complete change-over for separate settings, 100% coal gas or 100% producer gas being used as required. However, on installations with built-in or attached producer, complete change-over is not used, but the heating gases are mixed. These settings cannot therefore be heated by coal gas alone, but only by coal gas enrichment.'

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DISCUSSION

Mr. J. H. Daniels (Milford Haven), in a written contribution read by Mr. C. Field (Cardigan), said he had had 13 years experience with Jenkins intermittent vertical chamber ovens. On March 19, 1951, he shut down a chamber which was first charged on December 15, 1936, the long life of the bottom door being contributed to, he believed, by the use of copper-bearing steel. Tests had shown that the addition of 0.25% of copper to steel increased its life to nearly four times that of copper-free material. With iron the life was approximately doubled. Tests reported in 1934 showed that the loss in weight of copper-bearing and ordinary steels immersed in a 1% sulphuric acid solution bore a ratio of 6 to 1 in favour of the copper steel. It appeared to him that there was a strong case for using copper-bearing steel about a gasworks.

He had never found a need for bottom gas off-takes. If they were in fact a real necessity they should be provided with their own foul main and retort house governor. Was it not a fact that coke ovens managed successfully without bottom gas off-takes? He paid tribute to Jenkins' design in saying that the chamber which was under fire for 14½ years before being reset not only gave no trouble when being discharged, but was not distorted at the end of its life, although it had not been handled particularly kindly during a portion of that time.

Regarding housing of plant they had at one end of the scale buildings which looked as if they had been designed by a Victorian mutilator of beautiful cathedrals, but complete with modern dust extraction plant and some attempt at air conditioning, while at the other there was virtually no housing at all on the lines of coke ovens. He thought the designers of the Margam steel works were on the right lines, the principle there being to house the operation and not merely the plant, the whole housing being of a non-permanent nature, but skilfully designed so as to be functionally pleasing.

He pleaded for greater instrumentation and automatic control of plant, and quoted some significant observations from the Anglo-American Productivity Report on Heavy Chemicals. He suggested that adequate instrumentation and automatic control were the best means of enlisting the intelligence of the operating staff of a gasworks on whom in the long run productivity largely depended.

Upward and Downward Steaming

Mr. D. S. Davies (Abertillery) said Mr. Crowther had claimed to be more familiar with downward steaming, but they in Abertillery favoured the upward steaming process and carried out the practice very successfully. It was generally emphasised by the plant manufacturers that the breeze pad on the bottom doors should consist of breeze all above ½ in. mesh as breeze smaller than that contained a very high percentage of ash and might prove detrimental to the silica work in the lower region of the retort. In their particular case they had used breeze lower than ½ in. mesh and had not found it detrimental to the life of the chamber. In the case of downward steaming it would be essential to use breeze above ½ in. mesh due to the pressure which built at the bottom of the chamber and would be excessive with small breeze which bound and blocked the ports of the dome off-takes. It would seem necessary, therefore, in the case of downward steaming to have a very efficient screening plant to ensure the correct screening of the different sizes of breeze. If upward steaming could be carried out efficiently then breeze below ½ in. could be used as a breeze pad and this would obviate the double screening of breeze. With downward steaming the formation of scurf in the upper portion of the retorts was kept to a minimum, but at Abertillery with the particular Welsh coals carbonised they did not experience serious scurfing problems and the period that retorts were put off for scurfing was very small. Normally the major portion of the time off was taken up with spraying and washing of the retorts under the normal maintenance system.

Reference had been made to two types of doors, the water seal type, and, as the author stated, the water seal would normally blow at around 1 in. W.G. This restricted the use of airborne sealing as it was usual in that type of work to obtain a pressure of 6 to 7 in. in the chamber itself. They wanted at Abertillery to carry out airborne sealing and found it necessary to fill the water seal lute with wet clay, and that brought the pressure in the chamber to approximately 4 in. They then found they could carry out airborne sealing, but it did not prove very satisfactory because the retorts, owing to their age, were not in first class condition. They reverted to the welding system which they found very successful and which had considerably increased the life of the retorts. With intermittent vertical chambers the welding system was very practicable as the whole of the chamber was easily accessible from

the bottom discharge opening. He advised any engineer favouring the airborne sealing system to have metal to metal discharge doors.

The author had mentioned that much still needed to be done by way of storage and preparation of coke for the market. The intermittent vertical retort was, he suggested, one of the answers to that problem as that type of plant could carbonise coals which were not suitable for continuous vertical retorts. If a suitable blending plant were installed in conjunction with the retort house the same process could be carried out as was the practice in modern coke ovens, thereby enabling the gas industry to exercise the same degree of control of coke quality as existed in the coking industry and also enabling the gas industry to compete in the market for the cheaper coals which was now of the utmost importance when one of the deciding factors in present production costs was the excessively high cost of coal.

He was glad the author had referred to housing of plant. His own views were that where a retort house could be erected without interfering with local amenities the housing of the plant should be dispensed with on similar lines to coke oven practice. He felt sure there would be no additional maintenance costs and the capital cost of the plant would be considerably reduced. It was interesting to note that alternative coal gas firing of intermittent verticals had been successfully applied on the Continent. That might be one of the deciding factors in numerous manufacturing stations in different parts of the country where due to the present trend of grid integration those particular works were regarded as peak load and topping up stations as against the base load stations. Figures regarding the economics of that form of heating compared with the occasional use of carburetted water gas plants would be interesting.

Mr. S. L. Wright (Wales Gas Board) said he was somewhat confused by references to tonnage capacity instead of the usual tons throughput per day, but he thought the figures given in the paper relating to the holding capacity of the chambers were a tribute to the flexibility of the chambers. With regard to steaming he took it that the travel of gas from the charge was upwards through the top off-take, where it passed through a cracking phase and then downwards. One would expect there would be more scurf formation in the top than in the bottom. The effect of steaming was to attack that scurf, and that was one reason why it was not necessary to keep the chamber open for a long time for scurfing. It was possible that a reduction of upward steaming would have some effect in preserving the bottom sections, which were the first to go in the long life of the chambers. They in Wales were looking for the cheapest gaseous therms and were selecting plant to deal with local coals in order to save transport costs. The cheap coals offered by the National Coal Board were often of poor quality, and very often the poor quality was caused by high ash content, which appeared in a magnified form in the resultant coke. It was very difficult to make a suitable coke from cheap coals unless the National Coal Board would evaluate the ash content of its coals. Proper sampling systems were necessary so as to enable the industry to keep its grip on the coal used in the trend to increase prices.

Complete Gasification

Mr. W. Clark Jackson (Coal Officer, Wales Gas Board) said the better class coals were becoming more and more scarce and they would in due course have to operate on poorer quality coals. The poorer seams were still plentiful, and there was a good gas-making coal which unfortunately carried a high percentage of sulphur that made it practically impossible to use at present. Mr. Wright had pointed out the necessity for cleaning coals if they were to make available to their public a respectable quality coke on which they must continue to depend so long as they were a two-fuel industry. At very large works dealing with large quantities of coal it might be possible to find some solution to the cleaning problem, but he did not know how they were going to get the coal industry to provide the smaller works with clean coal, and from being a two-fuel industry they might find themselves compelled to become a one-fuel industry and go in for total gasification. That would take care of the high ash content that was going to be present in the coals of the future and it would also take care of the sulphur content which would otherwise depreciate coke to the extent that it would become unburnable in normal circumstances. He agreed that they should have an easy method of taking coal samples, and he hoped it might be possible to meet the Coal Board and see how far sampling could be advanced for their benefit. They would have to make gas with inferior coals and the contractors would have to look to the question of total gasification.

Mr. A. Pickard (Llanelly) said he would particularly like to thank Mr. Crowther for giving such clear details of the thought and care which the contractors devoted to the production of refractory materials in order to give the longest possible life. It was obvious that refractory materials were not erected without due consideration of all the stresses and strains to which they would be subjected under the varying conditions of pressure and heat.

Mr. Crowther, in a brief reply to the discussion, said he agreed with Mr. Daniels on the question of copper-bearing steel, but unfortunately they were not at present able to obtain it in sufficient quantity. Mr. Daniels had also referred to cathedral characteristics of gasworks buildings. In the case of an installation at Canterbury they had had to compete with the cathedral authorities, and he did not think they made a bad job of it. On the question of instrumentation he must point out that in America everything was standardised by instruments, but the question of costs must be considered. Instrumentation could be overdone to the extent that they might need more people to look after the instruments than to tend the plant.

Upward and downward steaming had been referred to both by Mr. Davies and Mr. Wright. Downward steaming had advantages in that the water gas reaction was taking place in the hottest part of the chamber. He also claimed that the downward steaming process had the advantage of minimising the formation of scurf, which took place mostly in the upper part of the chamber. The suggestion concerning heating by coal gas was based on the question of flexibility. Mr. Wright had spoken of coal throughput as against tonnage capacity. The question of coal throughput was entirely dependent on the coal quality and calorific value of the gas adopted. Volumetric output was more or less constant. There must be great advantage in carbonising local coals, and he believed coal blending was a growing necessity of the gas industry.

On the proposition of **Mr. H. Blythe,** seconded by **Mr. E. Aspinall,** a vote of thanks was accorded to Mr. Crowther, who briefly responded.

THE COOLING OF GASES AND VAPOURS—Continued from p. 430

unless sufficient data are available to enable the apparent increases in mass transfer values to be predicted.

Such data would apply to one particular design and arrangement of tubes, etc., but it is possible for a designer to find these criteria for standard arrangements and design economically and safely.

The Colburn and Hougen method makes it possible to predict the effect of change in water velocity (or better, Reynolds Criterion since this takes into account tube size) but would need simplification for day-to-day usage.

It is regretted that the paper cannot be extended to cover more examples, particularly for parallel flow, but it will be appreciated that the correlation of test data using Colburn and Hougen's method requires considerable work. The author would point out, however, that the two tests fully worked out were not isolated cases and that a great many more runs were undertaken and the two examples selected (from many worked out) as being reasonably accurate and representative.

The gas was supplied from an experimental retort at the works of West's Gas Improvement Co., Ltd., and the author is indebted to the company for the facilities placed at his disposal, and for the kindness shown by members of their Research Department during the period of the tests.

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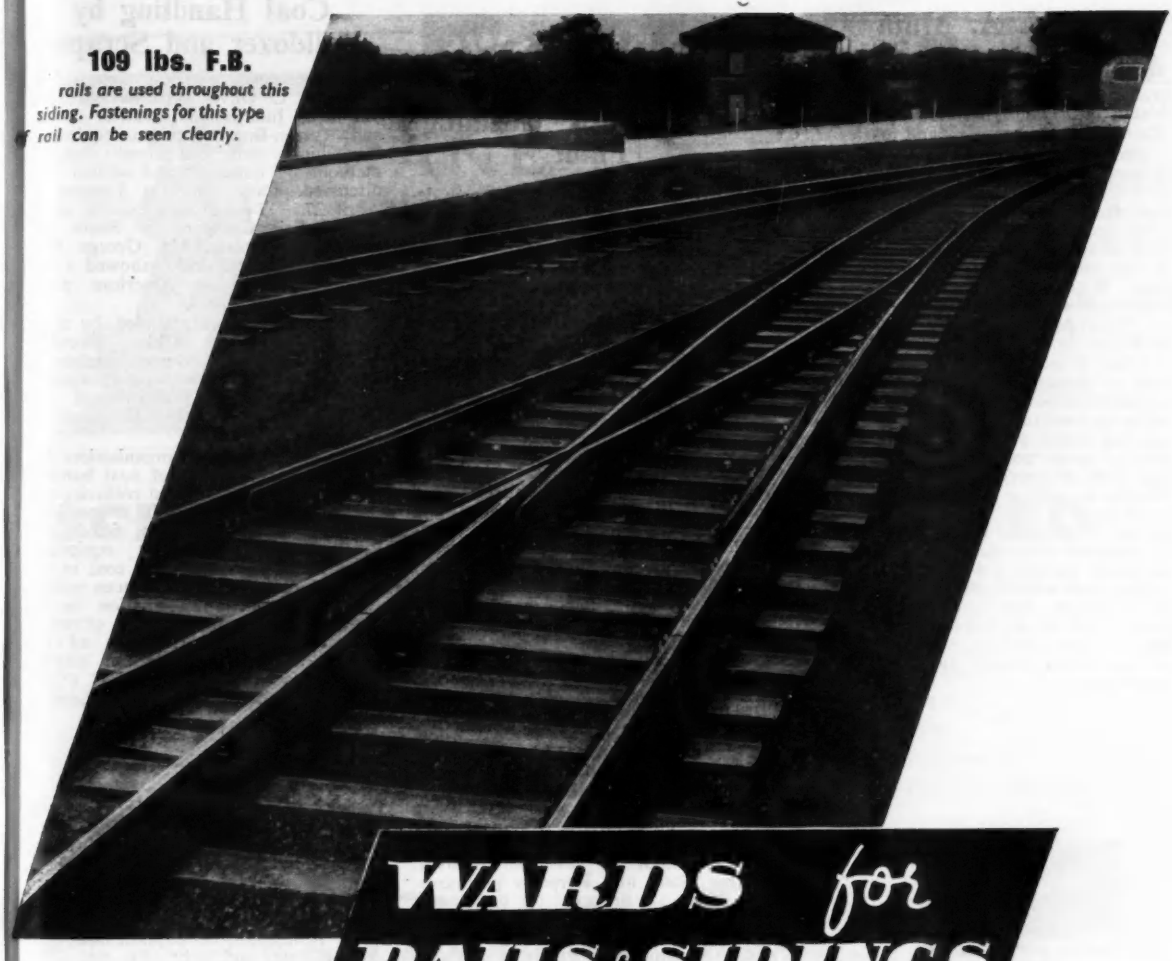

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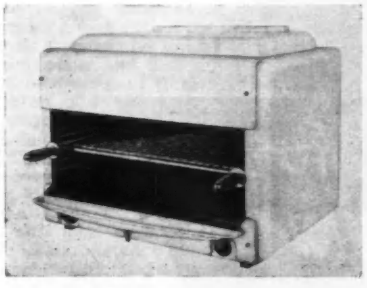
The new patented features incorporated in its design make this griller fast and economical. The heat-resisting steel frets fitted are used in conjunction with insulating bricks to give very rapid heating-up and high efficiency. The result is fast and even cooking over a large area. With the grill at equilibrium, the consumption is 1.25 B.Th.U. per sq. in. of toast. At 500 C.V. this is equivalent to 400 sq. in. of toast per 1 cu.ft. of gas.

After 5 min. from lighting, the full area of bread on the brander can be rapidly and evenly toasted and when fully heated the griller is capable of toasting bread on one side in 40 sec. on the top runner position. The total toasting area is approximately 350 sq. in. Results in grilling will, of course, vary according to the size, thickness, and quality of the food to be cooked and in the method of cooking adopted, but in an actual test about 4 lb. of steak spread evenly over the brander area was grilled to perfection very quickly. The steak was grilled on each side for 1 min. on the top runner position, and then lowered to the fourth runner to complete the operation.



Of cast iron construction, the griller is insulated by an asbestos fibre and aluminium foil lagging between the outer and inner casings of the body. An air cooling space, in conjunction with the insulation, ensures low surface temperature. The base of the griller slopes forward, allowing any overflow of fat to drain into a trough fitted at the front of the grill opening. A drain plug sited in the well of the trough allows the fat to be collected and clarified.

A standard governor regulates the supply of gas to the two sets of cast iron burners, which are located one set to each half of the grill. The right and left hand sections of the grill area are therefore separately controlled. Each burner is fitted with two banks of neat gas jets which fire between perforated heat-resisting steel frets and the moulded refractories. By this arrangement the jets are protected from any splashing of fat during the cooking operations while permitting easy access to the burners and fittings for maintenance purposes.

The full-on gas consumption is 48,500 B.Th.U. per hour, but this is automatically reduced by 20% within 20 min. without affecting the useful heat output.

The GG 222 griller is available in two finishes, dapple and cream.—*R. & A. Main, Ltd., 48, Grosvenor Gardens, London, S.W.1.*

TRADE NEWS

Producer Gas Cleaning Plant

GIBBONS HEURTEY offer a new design of cleaning plant, developed in France after World War II, applicable to any producer, with a gas outlet temperature of under 620°C., which in addition to giving a very clean gas with an impurity content not exceeding ½ grain per 100 cu.ft. recovers the by-products as water-free pitch and oil.

The plant comprises precooler, gas booster, final washer, and oil circulating system. The gas entering the primary cooler meets sprays of tar oil, which wash out the heavier fractions. These fall to the bottom of the vessel, where, warmed by the incoming gas and stirred by two heavy horizontal stirrers, they finally run off as pitch. The gas, ascending the primary cooler, meets further sprays of tar oil which wash out the lighter fractions, which run off to a storage tank from which they are pumped through coolers back to the sprays, the surplus passing to an export tank or wagon.

The gas leaving the primary cooler, containing only a trace of light oil, is then boosted up to the desired pressure by a standard centrifugal type fan and passes to the final water cooler, where the ammonia, phenols, and last trace of light oil are removed, and may then be passed to the furnaces.

There are now 12 of these cleaning plants operating on the Continent, with sizes ranging from 20,000 to 900,000 cu.ft. per hour on gas from Heurtey, Morgan, Stein and Kerpeley producers. Two plants are on order for building in Britain.—*Gibbons Heurtey, Ltd., Dibdale, Dudley, Worcs. London Office: 174, Palace Chambers, Westminster, S.W.1.*

SCHIELDROP & CO., LTD., Stotfold, Beds., have produced an illustrated brochure describing their self-proportioning gas burner for constant air-gas ratio.

Coal Handling by Bulldozer and Scraper

AN interesting meeting, arranged by the J. C. Oliver organisation, distributors of International crawler tractors and Ruston-Bucyrus tractor equipment, at which American coal handling methods by bulldozer and scraper were discussed, took place in London on April 27. Two visiting experts of the Bucyrus-Erie Company of South Milwaukee, Wisconsin, Mr. George Read and Mr. Henry Salcido, showed a film taken by them at American power stations.

The meeting was attended by representatives of the British Electricity Authority, the gas industry, engineering consultants, and commercial organisations interested in problems of coal handling. An interesting discussion followed the film.

The J. C. Oliver organisation has carried out a number of coal handling tests at power stations and collieries over the last two years, with International TD 18 crawler tractors fitted with Ruston-Bucyrus bulldozer equipment. As a result the output of coal moved over different distances has been reliably established. The information on the use of scrapers however, was extremely interesting as little experience of this method of coal handling has hitherto been available in England.—*J. C. Oliver, Ltd., Burton Street, St. Pancras, London, W.C.1.*

PROABD (ENGLAND), LTD., is a recently formed British Chemical Engineering Organisation. It is fully equipped for the design and manufacture of complete plant for the continuous distillation of tar, recovery of by-products, refining of solvents, extraction and refining of tar acids, production of naphthalene, benzole, toluole, and light oils, etc. The office at Wheatsheaf House, Carmelite Street, London, E.C.4, enjoys technical liaison with the Societe Proabd, of Nancy, France, the eminent Continental specialists in the design of similar equipment, and is under the management of Mr. A. F. Peart.

The stand of George Bray & Co., Ltd., manufacturers of gas burners of all types, at the Castle Bromwich Section of the British Industries Fair.

CRANE
valves
FOR STEAM, WATER,
OIL, GAS AND AIR

HAWKINS
IMPERISHABLE

JOINTING PASTE
Non-poisonous, cheaper and better than red lead, ideal for gas, steam or water.

IRON CEMENT
Looks like iron, can be buffed burnished or drilled and automatically caulks itself into any joint.

Also Manufacturers of Hawkite Paint.

W. T. HAWKINS & CO.
CHAPEL HILL, HUDDERSFIELD
Send for Sample Tin POST FREE
Sole Agents for Australasia:
W. T. HAWKINS (Australia) Pty. Ltd.
Hardware House, Hardware Street, Melbourne, Australia

n.d.h.

SCRAP GAS METERS WANTED

Top prices paid—Collection arranged from anywhere in U.K.

Sell to those best suited to deal with them.

Sell to — MITCHAM SMELTERS LIMITED
Rometal Works, Red House Road,
Mitcham Road . . . CROYDON . . . Surrey.
Tel: THOrnton Heath 6101. (Private Branch Exchange).

Truck Loads to our own private siding, Beddington Lane, Southern Region.

Plenty to Spare...

During the past few months, considerable re-organisation of our works has taken place: production is planned on an entirely new basis, with the result that output is increasing. This is particularly so with fittings, and deliveries can be made from stock as shown.

Your orders will be dealt with promptly and efficiently.

MAKING-UP PIECES available in the following sizes, black or galvanised, ⅛in., ¼in., ⅜in., ½in., ¾in., 1in., 1¼in., 1½in., 2in., 2½in., 3in. and 4in.

RUSSELL BROS (WALSALL) LIMITED
BRADFORD TUBE WORKS · WALSALL

"THE DOUGLAS PUMP"

SHEWN FITTED WITH SUCTION PIPE LINE STRAINER, GIVING CHOICE OF TWO SUCTION LINES, PUMP & STRAINER STEAM HEATED. GOOD SUCTION. SLOW SPEED.

WILLIAM DOUGLAS & SONS LTD.,
PUTNEY - - LONDON, S.W.15.

GRILL FRETS

THERE IS NO SATISFACTORY SUBSTITUTE FOR GENUINE CHROME STEEL.

CHROME GRILL FRETS

are available for all types of gas cookers.

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H. B. DREW LIMITED

BIDEFORD AVENUE,
PERIVALE, GREENFORD.

Telephone : Perivale 3238. Telegrams : Gasfret, Greenford. MIDDLESEX.

IN WIDE OPEN SPACES

OR CRAMPED LITTLE PLACES

HILMOR BENDS

with equal ease

- **Lightweight bench model and portable benders for the plumber.**
- **Rotary hydraulic benders for gas and steam tube.**
- **Hand and power-operated general purpose and short radius mandrel benders.**

HILMOR LTD.

(SALES AND SERVICE)

65, CALSHOT STREET, LONDON, N.1.

Telephone : TERminus 4714.
Telegrams :
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A PRACTICAL APPLICATION OF

JEAVONS

H.P. DISTRICT GOVERNORS

Photograph shows a duplicate set of 8" "Jeavons-Emco" High Pressure District Governors in brick built house.

Volumetric Governors and Holder Cut-off Valves also supplied.

★ **DUPLICATE OR SINGLE SETS WITH BYE PASS. SUPPLIED IN SIZES 2" TO 12"—HIGH OR LOW PRESSURE.**

JEAVONS ENGINEERING CO · TIPTON · STAFFS

'PHONE: TIPTON 2161 (5 Lines). PROPS: E. E. JEAVONS & CO. LTD. 'GRAMS: PIPELINES · TIPTON

PUBLISHERS' NOTICE

The "Gas Journal" is published every Wednesday, price 1/3d.; by post 1/5d.

Subscription Rates: Home and Empire :- 52/- per annum; Foreign :- 60/- per annum. (Both payable in advance.) A copy of the "Gas Journal" Calendar & Directory is presented each year to continuous subscribers.

Classified Advertisements: All small classified advertisements are charged at 1/9 per line (approx. 7 words) - minimum charge 10/6. A Box Number address occupies 2 lines, and a further 6d. is charged towards cost of postage on replies. Copy must be received by first post on Monday to ensure insertion in that week's Journal.

Displayed Advertisements: Rates obtainable on application to the Business Manager. Change of copy for displayed spaces must be received 14 days prior to publication if proofs are required. Type area of inside pages 10" deep x 7" wide; block screen 120.

BUSINESS MANAGER: S. T. CULLEN

MIDLANDS OFFICE: 10, Union Street, Birmingham.

NORTHERN MANAGER: W. Q. Foster, 33, St. Helens Road, Harrogate. 'Phone: Harrogate 84291.

WALTER KING, LTD., 11, Bolt Court, Fleet Street, London, E.C.4.

Telephone: CENtral 2236-7. Telegrams: Gasking, Fleet, London.

OXIDE

DUTCH AND DANISH BOG ORE SPECIALLY ACTIVATED OXIDE OF IRON

Oxide supplied on loan or sale outright.
Highest prices paid for Spent Oxide.

Send your enquiries to

GAS PURIFICATION & CHEMICAL COMPANY LIMITED

ESTABLISHED 1873

PALMERSTON HOUSE, OLD BROAD STREET, LONDON, E.C.2.

Telegrams: "Purification, Stock, London." Telephone: London Wall 5077

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MY LIFE LOST BUT FOR

NU-SWIFT!

"A match struck...an explosion... petrol-sprayed I became a living torch... but my 13-year old Nu-Swift Extinguisher saved me from agonizing death." Everyone has too many fire risks. What would you have done?

NU-SWIFT LTD. • ELLAND • YORKS

In Every Ship of the Royal Navy

"KLEENOFF" *

THE COOKER CLEANER

"KLEENOFF"

FIBRE BRUSHES
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KETTLE DESCALER

* *For resale to the public, and in bulk for Works use.*

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7, CROMPTON WAY, CRAWLEY, SUSSEX.

Offer Your

SCRAP GAS METERS

direct to the actual smelters

OAKLAND METAL Co. Ltd.

94 NEW BOND STREET, LONDON, W.1.

Phone: GROsvenor 5241-4
Works: Willington, Derby

IS NOW PRODUCED IN A NUMBER OF ATTRACTIVE

NEW AND BRIGHT COLOURS

Such as

STONE - LIGHT and DARK GREY
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'HUMIDINE' will outlast any other RUST prevention paint and costs far less

WRITE FOR SAMPLES OF SHADES and further details to the sole makers

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CARLETON - SKIPTON - YORKS.

'Phones: SKIPTON 540/9.

ndh 567

APPOINTMENTS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive or a woman aged 18-59 inclusive unless he or she, or the employment, is exempted from the provisions of the Notification of Vacancies Order, 1952.

LADY for duties in London showrooms of gas appliance manufacturer. Must have personality and preferably have had experience in the gas industry. Apply in own handwriting, stating age, experience and salary required to: The Secretary, R. & A. Main, Ltd., 48 Grosvenor Gardens, S.W.1.

SHOP SUPERINTENDENT required for well-known Gas Meter Establishment in the Midlands, having full knowledge of gas meter assembly and capable of strict supervision. Previous experience in similar position essential. Write, stating age, experience and salary required to: No. 150, *Gas Journal*, 11, Bolt Court, Fleet Street, London, E.C.4.

BRITISH ENGINE BOILER AND ELECTRICAL INSURANCE COMPANY, LTD.,

24, Fennel Street, Manchester, 4.

GASHOLDER SURVEYORS

THE COMPANY has a vacancy for a surveyor. Permanent position; progressive salary scale £540 to £785, with non-contributory pension. Candidates age 26 to 34 years, who have served an apprenticeship with a reputable firm of gasholder manufacturers are invited to apply stating age and qualifications. Knowledge of both riveted and welded construction an advantage.

EAST MIDLANDS GAS BOARD

NOTTS AND DERBY DIVISION.

DERBY UNDERTAKING.

ASSISTANT DISTRIBUTION ENGINEER

APPLICATIONS are invited from suitably qualified persons for the above appointment.

Applicants must have experience in High and Low Pressure Gas Distribution and Mainlaying, and possess the Institution of Gas Engineers' Certificates in Gas Engineering (Supply). Salary Grade A.P.T. IX Provincial 'A', (Scale £615/715 per annum), commencing at a figure commensurate with qualifications and experience.

The successful candidate may be required to pass a medical examination, and unless already subject to a pension scheme by virtue of the Gas (Pension Rights) Regulations 1950, will be required, if eligible, to join the Board's Staff Pension Scheme within six months from taking up the appointment.

Applications, stating age and experience, giving full particulars of training and qualifications, together with the names of two referees, should be submitted to the undersigned not later than Saturday, May 30, 1953.

K. L. Pearce,
Divisional General Manager.

East Midlands Gas Board,
Notts. & Derby Division,
Friar Gate,
Derby.

EAST MIDLANDS GAS BOARD

LEICESTER AND NORTHANTS DIVISION

GROUP MANAGER—

NORTHAMPTON

APPLICATIONS are invited for the position of GROUP MANAGER, Northampton. The commencing salary will be not less than £1,450 per annum, and applicants must have wide experience in all branches of the gas industry.

The Group, which consists of the Northampton undertaking and two small undertakings, has a total annual make of approximately 2,000 million cubic feet of gas and supplies 48,000 consumers in an area of some 300 square miles.

The successful candidate may be required to pass a medical examination and, unless already subject to a pension scheme by virtue of the Gas (Pension Rights) Regulations 1950, will be required, if eligible, to join the Board's Staff Pension Scheme within six months from taking up the appointment.

Applications stating age, education, qualifications and experience, and giving the names of two referees, should be addressed to the undersigned to be received not later than June 5, 1953.

A. Gwynne Davies,
Secretary

Beverley House,
University Road,
Leicester.
May 15, 1953.

(*Classified advertisements continued on Supplement 4*)

APPOINTMENTS VACANT (ctd.)

SCOTTISH GAS BOARD

WESTERN GROUP

JOHNSTONE DISTRICT

APPLICATIONS are invited from suitably qualified persons for the position of MANAGER of above District and any extension thereof.

Applicants, who must be Corporate Members of the Institution of Gas Engineers, should have wide experience in the control, operation and administration of a medium sized Gas Works.

The salary will be on a Scale £825–£1,075 per annum, with annual increments of £50, and placing will be according to qualifications and experience. A house for which rent will be paid is available.

The successful applicant will require to pass a medical examination and will be required to join the Board's Pension Scheme.

Applications, endorsed "District Manager—Johnstone," stating age, training, qualifications and experience, together with the names of two referees, should reach the undersigned on or before Saturday, June 6, 1953.

ALEX. JAMIESON,
Group Manager.

Inchgreen Gas Works,
Greenock.

WEST MIDLANDS GAS BOARD

SHROPSHIRE DIVISION.

DISTRIBUTION SUPERINTENDENT—

SHREWSBURY DISTRICT.

THE SALARY for the post will be within Grade VIII (£585–£665 per annum) of the National Salary Scales for Gas Staffs.

Candidates should be experienced in mainlaying practice, capable of preparing estimates and specifications, and supervising Contractors work on both high and low pressure systems. The responsibilities also include the general administration of the gas Distribution Department, showroom and Sales and Service organisation.

The post is pensionable and the successful applicant may be required to pass a medical examination.

Applications, stating age, personal details, qualifications and experience, and the names of two referees, should be addressed to Mr. C. M. D. Belton, Divisional General Manager, West Midlands Gas Board, Shropshire Division, Sidney House, School Court, Shrewsbury, to reach him within fifteen days of the appearance of this advertisement.

F. H. CURETON,
Secretary to the Board.

WEST MIDLANDS GAS BOARD

BIRMINGHAM AND DISTRICT DIVISION

SENIOR DRAUGHTSMAN

DISTRIBUTION DRAWING OFFICE

BIRMINGHAM DISTRICT

THE work of the Drawing Office includes the preparation of plans in connection with housing and industrial development, gas compressing stations of various types, and holder stations, particularly in connection with high pressure systems.

Candidates should be trained in gas and/or mechanical engineering and preferably possess the Higher Grade certificate in Gas Engineering (Supply) or the Higher National Certificate in Mechanical Engineering.

The salary will be within Grade X (£665–£765 per annum) of the National Salary Scales for Gas Staffs.

The post is pensionable and the successful applicant may be required to pass a medical examination.

Applications, stating age, personal details, particulars of training, experience and qualifications, together with the names of two referees, should be addressed to Mr. J. E. Wakeford, Divisional General Manager, West Midlands Gas Board, Birmingham and District Division, Gas Offices, Edmund Street, Birmingham, 3, to reach him within fifteen days of the appearance of this advertisement.

F. H. CURETON,
Secretary to the Board.

WEST MIDLANDS GAS BOARD

DIVISIONAL DISTRIBUTING ENGINEER—

WARWICKSHIRE DIVISION

APPLICATIONS are invited for the above post, which is based at Coventry.

Candidates should be qualified Engineers with knowledge and experience of planning and carrying out schemes for the distribution of gas by low, medium and high pressure.

The salary for the post, which is pensionable, will be £1,000 per annum, and the successful candidate will be required to pass a medical examination.

Applications, stating age, qualifications and experience, together with the names of two referees, should be addressed to the Industrial Relations Officer, West Midlands Gas Board, 6, Augustus Road, Edgbaston, Birmingham, 15, to reach him within fifteen days of the appearance of this advertisement.

F. H. CURETON,
Secretary to the Board.

SENIOR DRAUGHTSMAN required. Experienced in the design of purification and storage plant for the Gas Industry. Alternatively, having knowledge of steel and cast iron tanks, and structural work. Permanent situation with excellent prospects of advancement for first-class man. Superannuation scheme and other advantages. State full details and salary required to: No. 152, *Gas Journal*, 11, Bolt Court, Fleet Street, London, E.C.4.

WALES GAS BOARD

BARMOUTH UNDERTAKING.

APPLICATIONS are invited for the position of MANAGER of the above Undertaking within the Salary Grade A.P.T. VI.B. (£475/555 per annum, inclusive of emoluments—a house will be available.).

Applicants should possess sound experience in gas manufacture and distribution and should be capable of carrying out successfully the administrative and other duties of the post.

The successful applicant will be required to pass a medical examination and to join the Board's Superannuation Scheme.

Applications, giving age, qualifications, present position and experience, together with the names of two referees, should reach the undersigned not later than June 6, 1953.

C. B. MAWER,
Secretary.

1/2, Windsor Place,
Cardiff.

EASTERN GAS BOARD

NORWICH DIVISION

DIVISIONAL ENGINEERING DRAUGHTSMAN

APPLICATIONS are invited for the above position at a salary within Grade A.P.T. IX of the National Salary Scales.

Candidates must be experienced in general engineering draughtsmanship and have knowledge of the design and construction of Gasworks plant and buildings. Preference will be given to applicants having a recognised qualification of one of the Engineering Institutions or its equivalent.

The person appointed will be required to assist the Divisional Engineer in the setting up of an adequate Divisional Drawing Office and the position offers prospects of advancement.

The successful applicant will be required to pass a medical examination and join the Board's Staff Pension Scheme. Applications giving full details, together with the names of two referees, should be addressed to the undersigned by May 30, 1953.

RONALD A. WESTON,
General Manager.

Norwich Division,
Eastern Gas Board,
Thorpe Lodge,
1, Yarmouth Road,
Norwich.

PATENTS

KINGS PATENT AGENCY, LTD.
(Director, B. T. King, A.I.Pl.E., Patent Agent.) Advice, Handbook, and Consultations free. 146a, Queen Victoria Street, London, E.C.4. 'Phone: City 6161.

PLANT WANTED

REQUIRED:— a second-hand HOLMES B.M. METER up to 12,000 ft. capacity, state price. Apply—No. 151, *Gas Journal*, 11, Bolt Court, Fleet Street, London, E.C.4.

PUBLICATIONS

GAS ACCOUNT CALCULATORS

SUPPLIED either by Price per Therm or Thousand, for any specified Calorific Value, in book form, office charts, or pocket charts for Meter Inspectors, printed in clear type. Write for particulars to F. H. WAKELIN, LTD., Calculator Specialists, 354 WHEELER STREET, BIRMINGHAM.

'Phone: Northern 0989. 'Grams: Reckoners B'ham.

THE BRITISH GAS PURIFYING MATERIALS CO., LTD.

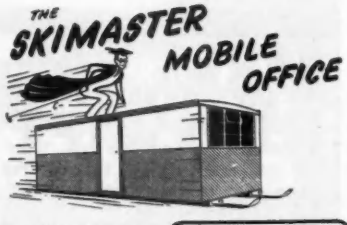
NATURAL BRITISH.

BOG (DUTCH and DANISH) ORE.

SPENT OXIDE.

LONDON ROAD, LEICESTER.

Telegrams: "BRIPURIMAT"
Telephone: 59086



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Send for illustrated lists

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Grosvenor Works, Linthwaite, Huddersfield, 8.4, and Ludgate Gardens, London, E.C.4.

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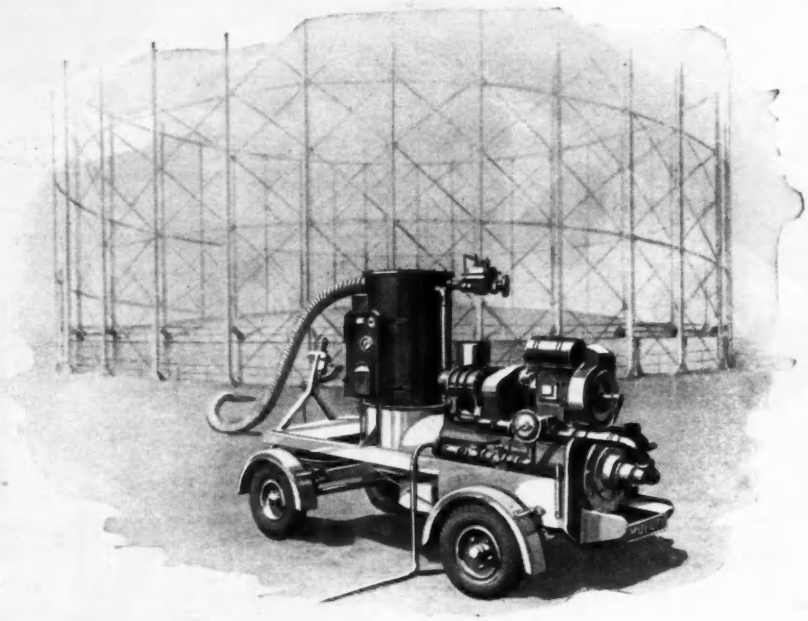
ALBION WEST BROMWICH

S.B

IRON & STEEL
PLATES &
SHEETS
BARS & SECTIONS

Telephone:
WEST BROMWICH 0436-7



INERT GAS GENERATORS

THESE machines were first introduced into this country in 1934, to meet the need for purging Gas Works plant and mains. Such a procedure has become increasingly recognised by the Industry as a desirable safety measure prior to repair work and to routine purifier operations.

Two types are available, one for oil firing and the other for gas firing and either can be supplied as a static or mobile unit.

W. C. HOLMES & CO. LTD.

HUDDERSFIELD · LONDON · BIRMINGHAM

Tel: Huddersfield 5280 London: Victoria 9971 Birmingham: Midland 6830

HOLMES HUDDERSFIELD

C406

we serve to burn

"Fishtail" type burner *with two-armed stamped pattern injector for heating liquid in tanks by submerged horizontal combustion tubes. For use with low pressure gas supplies.*
Size Range: *1", 1¼", 1½", 2" and 2½" outlets.*
Capacity Range: *45-280 cu. ft. of gas per hour.*

Note.—These four burner heads are for high pressure gas or low pressure gas and air blast.

Brass non-blow-off head types: *deal with 5 to 10 cu. ft. of gas per hour.*

Stainless steel, "F" type head, burner: *deals with 8 cu. ft. of gas per hour.*

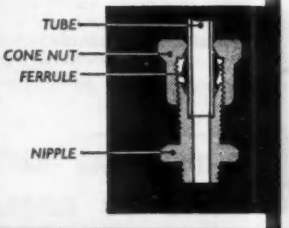
Perforated head type burner: *deals with 10 or 15 cu. ft. of gas per hour.*

Type 2 Mixture Controller, *for controlling quality of air mixture irrespective of varying pressures and resistances. Temperature control is varied by manipulation of the air cock only.*
Capacity Range: *from 130 to 1380 cu. ft. of gas per hour according to air pressure (¼ lb. to 1 lb.) and size. For low pressure systems.*
Air Inlets: *1", 1¼", 1½" and 2" diameters gas thread.*

INDUSTRIAL GAS EQUIPMENT

DID YOU KNOW?

KEITH BLACKMAN have been making compression joints for many years and the present design embodies features developed as a result of this long experience. Notice that the shape of the ferrule is such that the joint is made without unduly stressing the tube.



Keith Blackman LIMITED
MILL MEAD ROAD, TOTTENHAM, LONDON, N.17
Phone: Tottenham 4522 (twelve lines) "Grams: "Keithblac, Norphone, London."
BRANCH OFFICES: AT MANCHESTER, BIRMINGHAM, LEEDS, GLASGOW, NEWCASTLE-ON-TYNE, PENARTH near CARDIFF, AND BELFAST

510

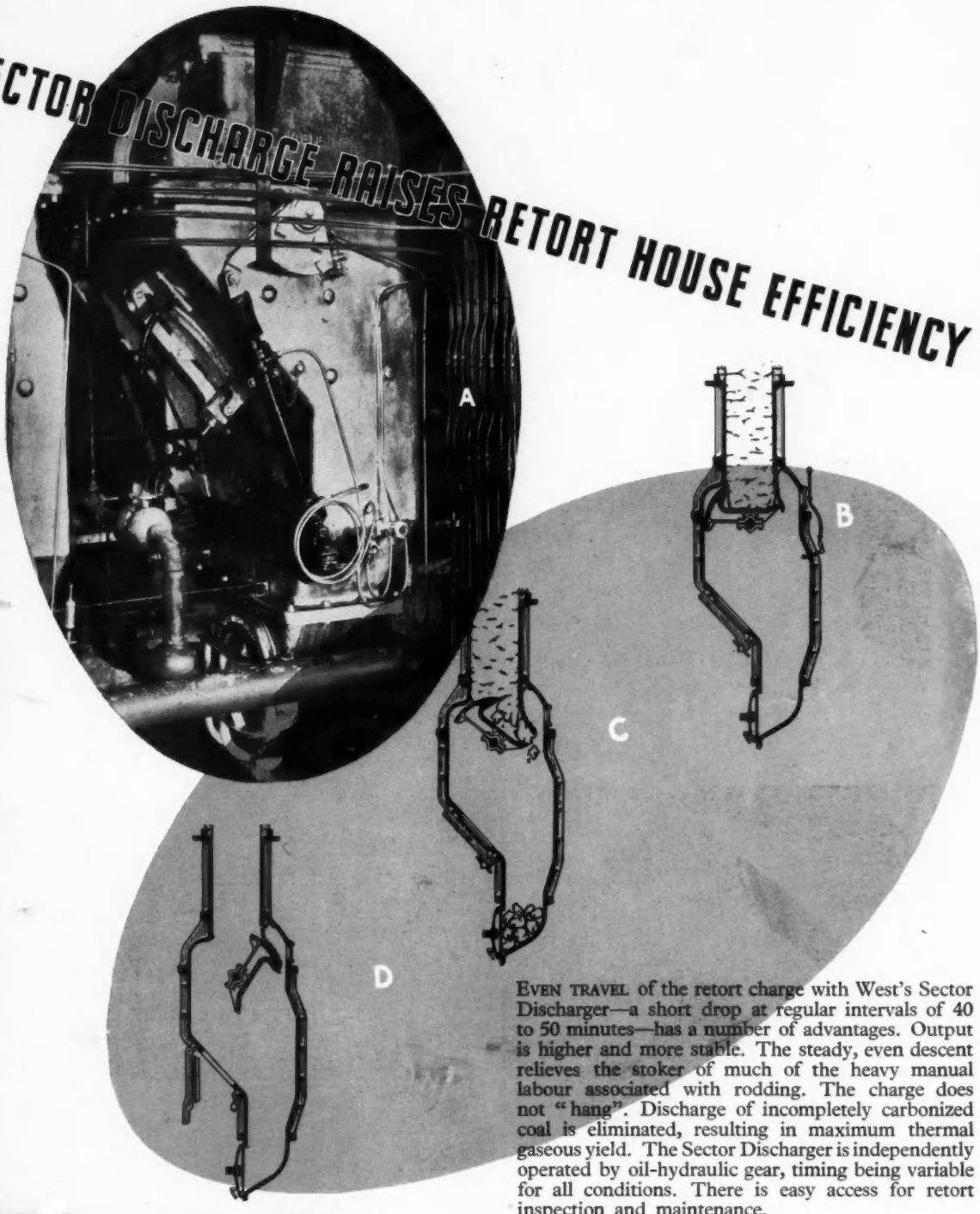
an ACCURATE Indicating Thermostat

This Instrument which has a differential of 1% of the scale range and is fitted with 5 amp Micro Switch, is available within the range of -240°F to +400°F.

The ACCURATE RECORDING INSTRUMENT Co
(ARIC LTD.)
ARIC WORKS . GARTH ROAD . LOWER MORDEN . SURREY . DERwent 2211/2/3

Printed by Straker Brothers Ltd., E.C.2, for Walter King, Limited, 11, Bolt Court, Fleet Street, London, E.C.4, Wednesday, May 20, 195

SECTOR DISCHARGE RAISES RETORT HOUSE EFFICIENCY



EVEN TRAVEL of the retort charge with West's Sector Discharger—a short drop at regular intervals of 40 to 50 minutes—has a number of advantages. Output is higher and more stable. The steady, even descent relieves the stoker of much of the heavy manual labour associated with rodding. The charge does not "hang". Discharge of incompletely carbonized coal is eliminated, resulting in maximum thermal gaseous yield. The Sector Discharger is independently operated by oil-hydraulic gear, timing being variable for all conditions. There is easy access for retort inspection and maintenance.

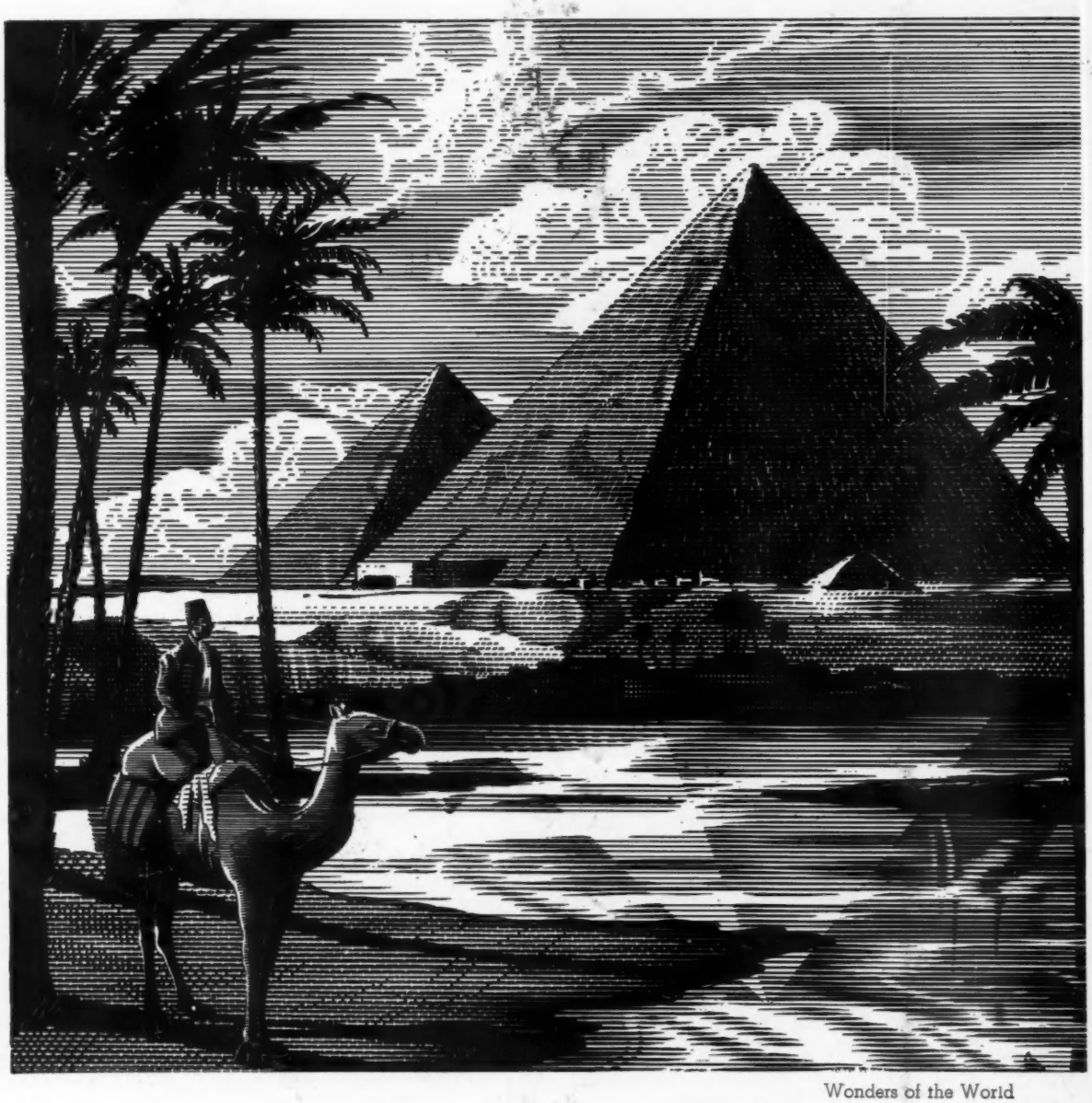
Illustrations: A. Exterior view showing oil-hydraulic drive. B. Discharger at rest. C. Operating. D. Access position for inspection of empty retort.

West's Gas IMPROVEMENT CO. LTD.

ALBION IRONWORKS . MILES PLATTING . MANCHESTER 10

Telephone: COLlyhurst 2961 Telegrams: Stoker, Manchester

London Office: Columbia House, Aldwych, W.C.2 Phone: HOLborn 4108-9 Grams: Wesgasco, Estrand



Wonders of the World

The PYRAMIDS of EGYPT

THE largest was the Great Pyramid of Cheops built about 3,000 B.C Nearly ten years were spent preparing the 12 acre site and 100,000 men were employed for twenty years constructing the immense tomb which when completed was originally 481 ft. high

The Wonders of the Modern World will be chronicled by posterity and will reveal the indispensable contribution of steel tubes to these achievements.

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